THE HEATING AND VENTILATING MAGAZINE

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NEW YORK, NOVEMBER, 1915.

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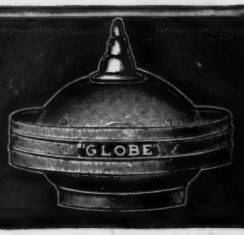

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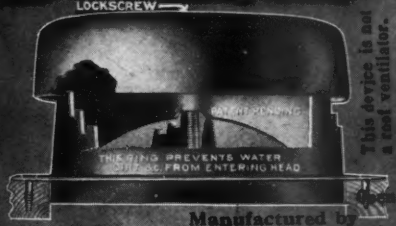

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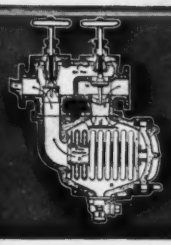

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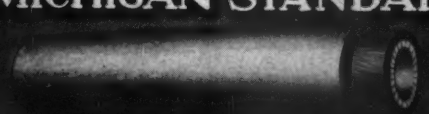

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THE HEATING AND VENTILATING MAGAZINE

1123 BROADWAY NEW YORK NOVEMBER, 1915

Hot Water Heating on a Large Scale

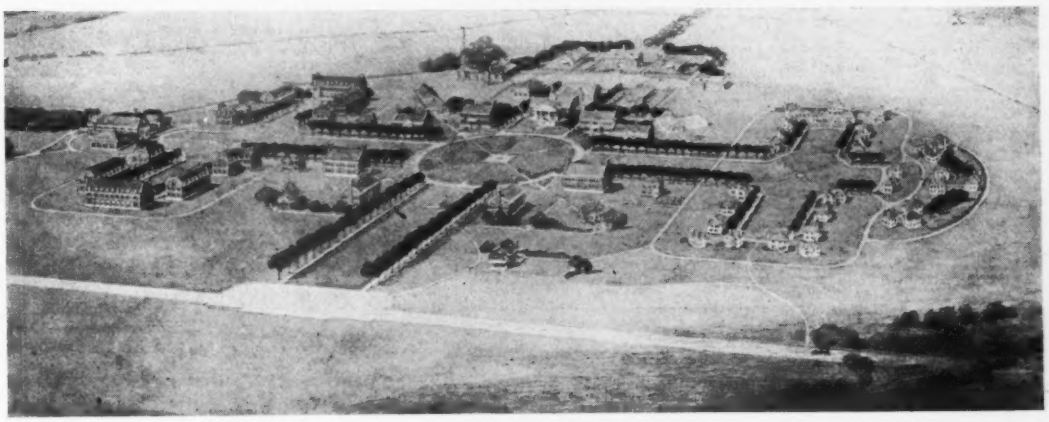
CENTRAL HEATING PLANT FOR THE STATE SCHOOL OF AGRICULTURE, FARMINGDALE, LONG ISLAND.

For the past three years the Departmen of Agriculture of the State of New York, under the direction of Lewis F. Pilcher, State architect, and G. B. Nichols, chief engineer, has been giving considerable study to the problem of heating institutions from a central plant. With the large number of institutions under its direct observation, it has come to the conclusion that an institution can be so designed that, in the arrangement of its buildings to the power-house location, forced hot water heating is preferable. This is particularly so where the institution is built on a large flat plateau, or where the buildings are divided into groups, each group being on a flat plateau, with the groups as few in number as possible.

There is also considerable advantage in having the buildings arranged in loops, each loop being fed by a one-pipe underground system, the power house being located on the loop. There has also been forcibly brought to the attention of this department both the lack of definite information in connection with this form of heating and also the difference of opinion on the subject that exists among recognized engineers.

After a great deal of study had been given to the establishment of one of the larger institutions, it was decided that at the Long Island Agricultural School, Farmingdale, Long Island, a central forced hot water heating system could be designed that would fulfil all of the requirements of this system for economical operation.

The school is planned for both sexes and will accommodate, when complete,

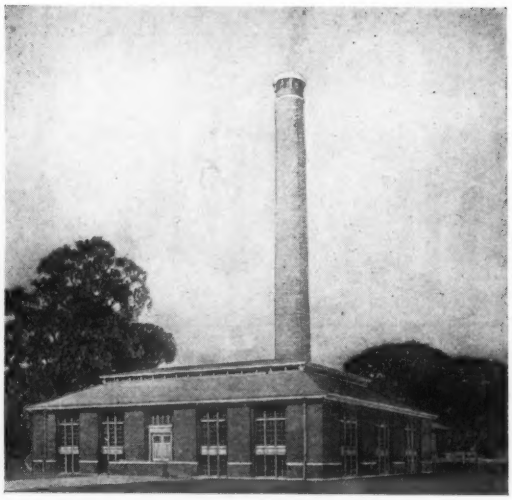


GENERAL VIEW OF STATE SCHOOL OF AGRICULTURE, FARMINGDALE, L. I.

1,000 pupils, which forms the basis of the design.

The arrangement of buildings centers about two perpendicular axes, as shown on the accompanying block plan. Approximately at the extremity of one of these axes is located the power house. To the west of the center is located the boys' group, consisting of two-story dormitories, and on the same axis, to the extreme east, is located the girls' group, which will consist of two-story cottages, in which the girls can live in small groups. Near the center of the institution are located the school and administration buildings, together with buildings for the study of agricultural purposes. All of these buildings are located on a large flat plateau, approximately 2,000 ft. in length by 1,500 ft. in length on the other axis.

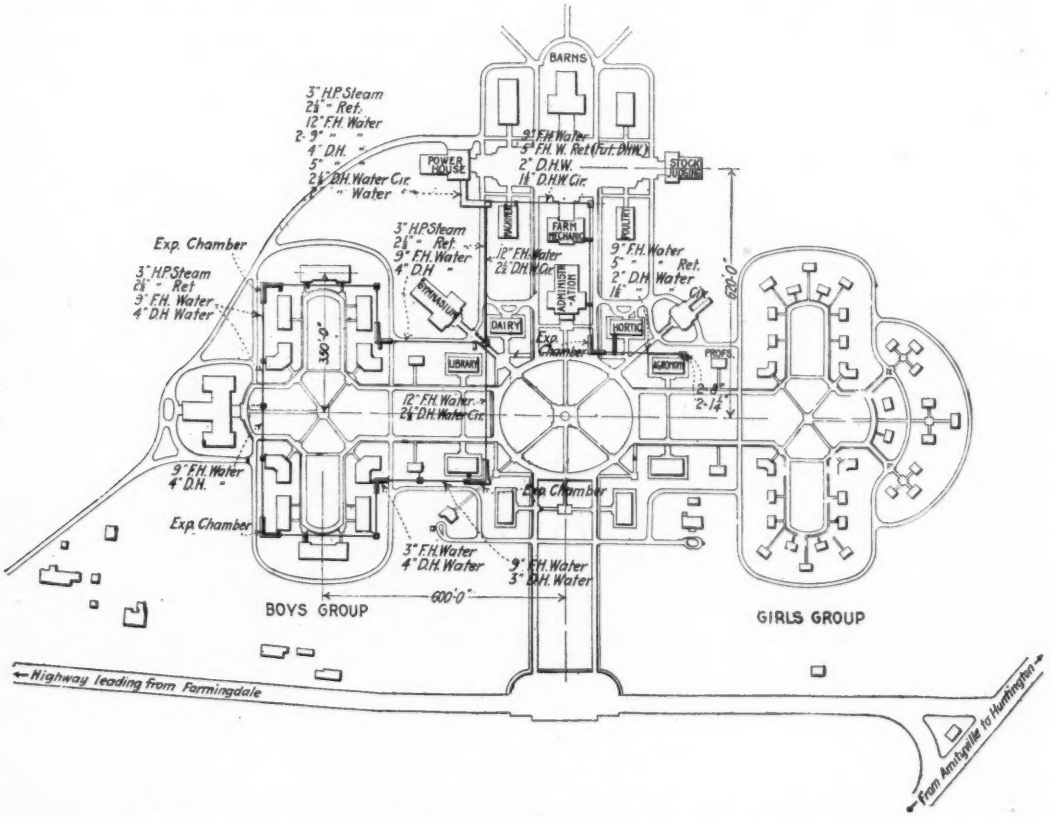
The design calls for approximately 100,000 sq. ft. of equivalent direct radiation for this institution, one-half of which is located in the boys' group and one-half in the girls' group.



POWER HOUSE, STATE AGRICULTURAL COLLEGE.

PRESENT INSTALLATION FOR BOYS' GROUP.

The larger number of buildings to be erected at the present time are located in the boys' group and there has already been installed a central hot water heat-


BARNS
POWER HOUSE
STOCK JUDGING
FARM MECHANICS
POULTRY
DAIRY
GYMNASIUM
ADMINISTRATION
NORTH
AGRONOMY
LIBRARY
PROFS
Exp. Chamber
3" H.P. Steam 2½" Ret. 12" F.H. Water 2-9" " " 4" D.H. " 5" " 2½" D.H. Water Cir. " Water "
3" H.P. Steam 2½" " Ret. 9" F.H. Water 4" D.H. "
12" F.H. Water 2½" D.H. W. Cir.
9" F.H. Water 5" " Ret. 2" D.H. Water 1½" " Cir.
3" H.P. Steam 2½" " Ret. 9" F.H. Water 4" D.H. Water
9" F.H. Water 4" D.H. "
12" F.H. Water 2½" D.H. Water Cir.
3" F.H. Water 4" D.H. Water
9" F.H. Water 3" D.H. Water
380'-0"
600'-0"
620'-0"
BOYS GROUP
GIRLS GROUP
Highway leading from Farmingdale
From Amityville to Huntington

BLOCK PLAN OF NEW YORK STATE SCHOOL OF AGRICULTURE, FARMINGDALE, L. I.

ing, one-pipe, underground loop, starting from the power house and running alongside of site of each building in the boys' group, thence returning to the power house. This loop consists of a 9-in. forced hot water heating main, together with a 4-in. domestic hot water main, both run underground in sectional tile conduit of the Johns-Manville Company's manufacture.

That portion of the main from the power house to the center of the boys' group consists of a 12-in. forced hot water main, which portion has been increased in size to provide for a future similar loop running through the girls' group. At the present time, only a portion of this second loop has been installed and the future domestic hot water return is temporarily being used as the return for the forced hot water heating system and temporary domestic hot water pipes have been installed for the buildings now being erected on the east loop.

The buildings are connected to the mains by walking tunnels approximately 20 ft. in length so as to provide for expansion of pipes. At the changes in direction in the underground mains, anchors or expansion chambers have been provided, the length of the expansion chambers being determined by the amount of expansion in the pipe between chamber and anchor.

TWO-PIPE GRAVITY SYSTEM USED.

All of the buildings are piped on the two-pipe gravity system, and the flow and return mains are connected to the underground main within a few feet of each other. The floor main rises at the entrance to building to the basement ceiling, while the return is run near the floor line.

The power house consists of a two-story, brick building, the upper portion of which, for the present, will be used for school purposes; when the institution has been completely developed, this will be used for a laundry. This location is of considerable advantage, as in institutional work, it has been found that a greater portion of the domestic hot water, steam and electric service is consumed for laundry purposes; therefore, the site of this activity should be as near as possible to the power house supplying these services.

High pressure steam is also to be carried to the kitchen building at the center of the boys' group, although it is believed that in the near future, on account of the high maintenance cost of this main, which is in continual use throughout the year, that electric cooking may be substituted in the finally-developed plan for this institution, thereby eliminating loss on these high pressure steam mains for continual use for minimum service only.

ARRANGEMENT OF POWER HOUSE.

It will be noticed from the first-story floor plan of the power house that the building is divided into three portions; one part arranged to accommodate the engine, pumping equipment and water heaters; a second part consisting of the boiler room; and the third, coal pockets; with smaller rooms for engineer's office, supplies, locker, engineer's toilet, and employees' toilet.

The building is so designed that the boiler room and coal pocket can be indefinitely extended, making it possible to only build a portion of the building at the present time; also that the coal pocket can grow in proportion to the size of the boiler room.

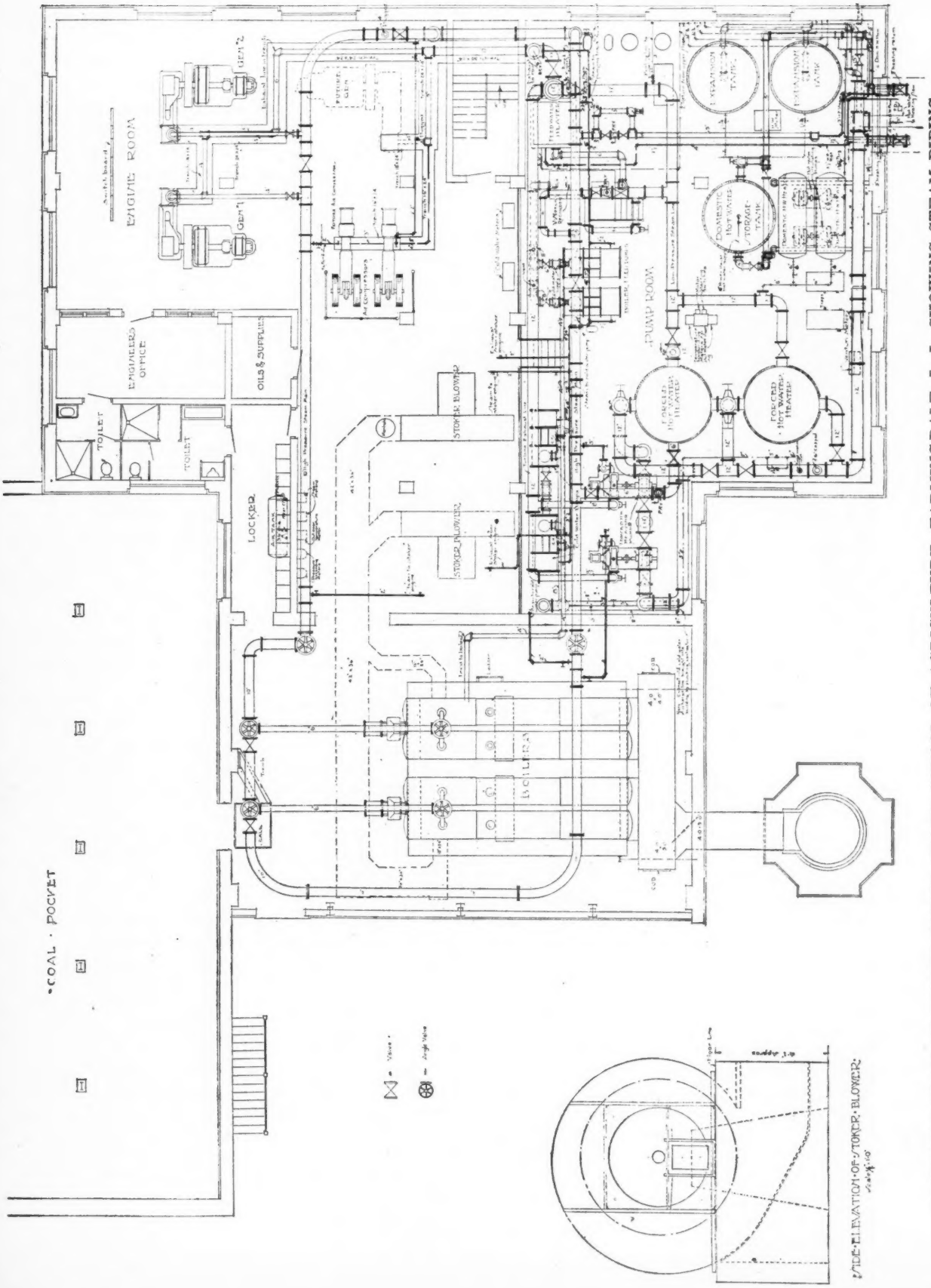
It has been found by experience that the demand for increase in electric power has been very small in this class of service, as with the increase in lamp efficiencies, the increase in demand for this class of service has been less than the decrease due to increase in lamp efficiencies.

The stack is a radial brick stack, 150 ft. high by 6 ft. 6 in. in diameter.

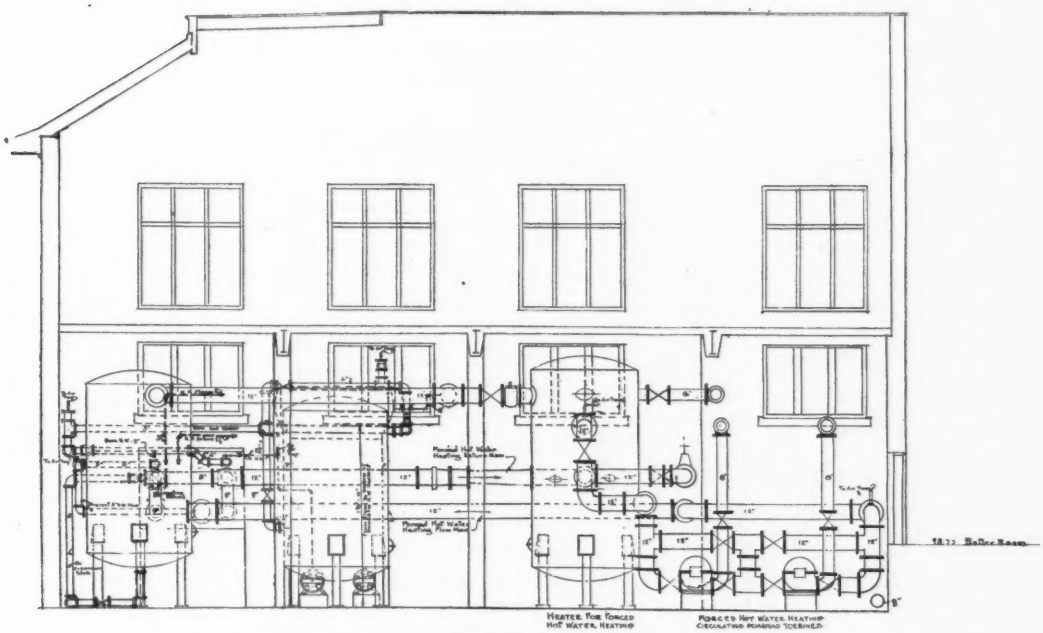
At the present time, there has been installed two 200 H. P. Keeler non-sectional water-tube boilers, with red pressed brick outer walls, Jones underfeed stokers, and two direct-connected blowers, each designed for a maximum of 1,200 boiler H. P.

In the engine room there has been installed two 50 K. W., 3-phase, 60 cycle, 2,300 volt, alternating current, Fort Wayne generators, with direct-connected exciters and direct-connected Harrisburg Foundry & Machine Company's engines.

The switchboard is of marble and con-



BASEMENT PLAN OF POWER HOUSE, STATE SCHOOL OF AGRICULTURE, FARMINGDALE, L. I., SHOWING STEAM PIPING.



SECTION THROUGH PUMP ROOM.

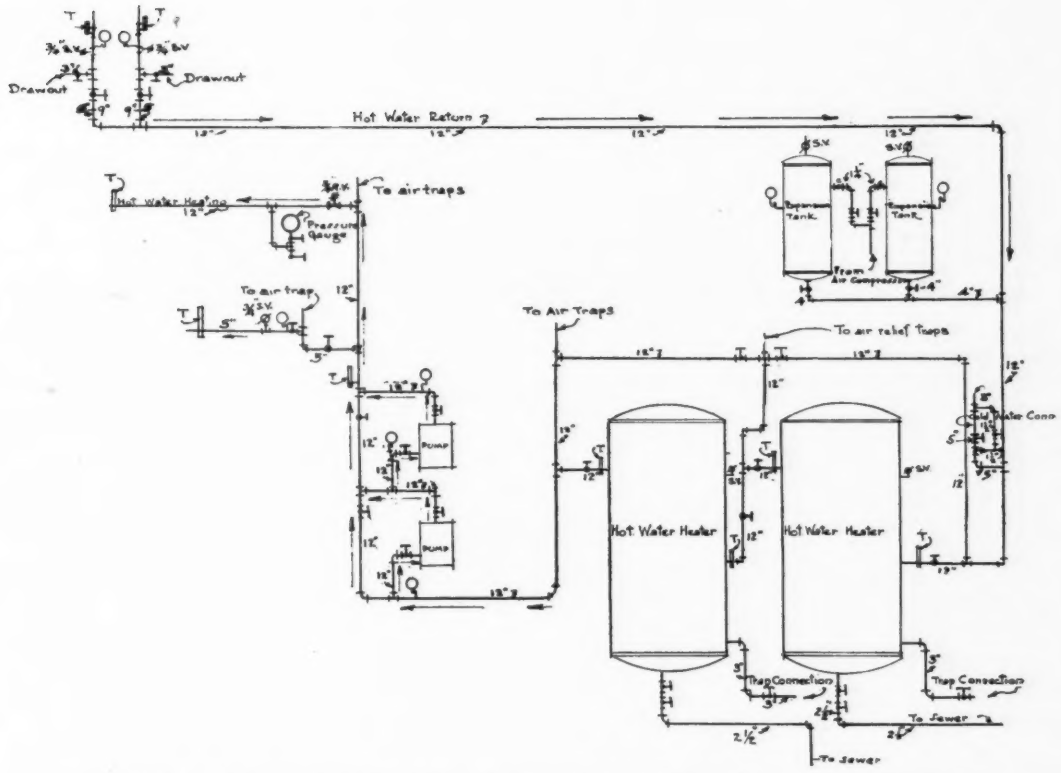


DIAGRAM OF CONNECTIONS FOR FORCED HOT WATER HEATING SYSTEM.

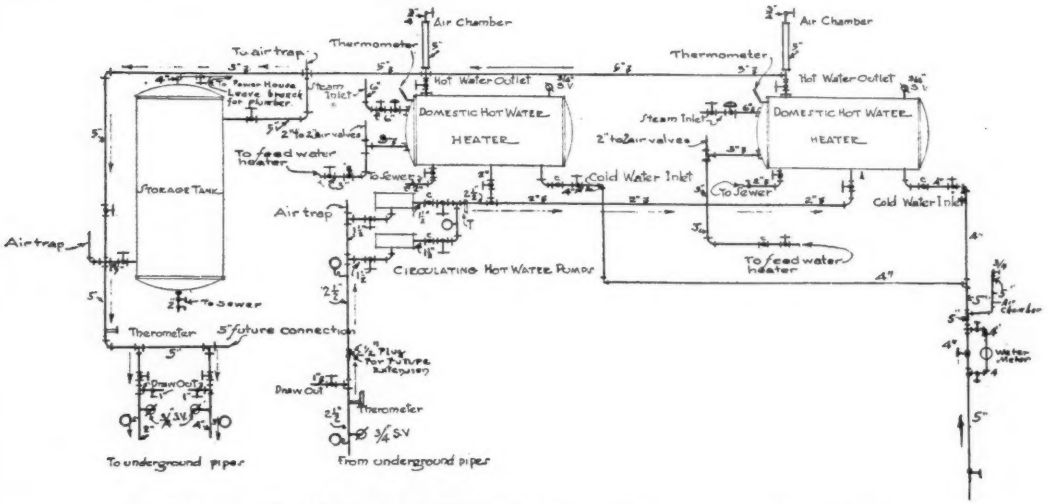


DIAGRAM OF DOMESTIC HOT WATER HEATER CONNECTIONS.

sists of generator and feeder panels, also furnished by the Fort Wayne Electric Company.

The water supply of the institution is taken from artesian wells located in the vicinity of the power house. These wells are to be pumped by air lift to a concrete receiving basin, located at the surface of the ground. The air compressors are located near the generators and are of the Laidlow-Dunn-Gordon manufacture. From the receiving basin the water is to be pumped by two force pumps to a steel tower tank located at the highest point of the institution directly behind the power house.

The forced hot water heaters consist of two Sims steam-tube heaters, especially designed for this class of service, as shown on the accompanying detail, and consist of an 8 ft. in diameter tank, in which are located 664 2-in. tubes, each tube being 6 ft. long, thereby giving 2,100 sq. ft. of heating surface for

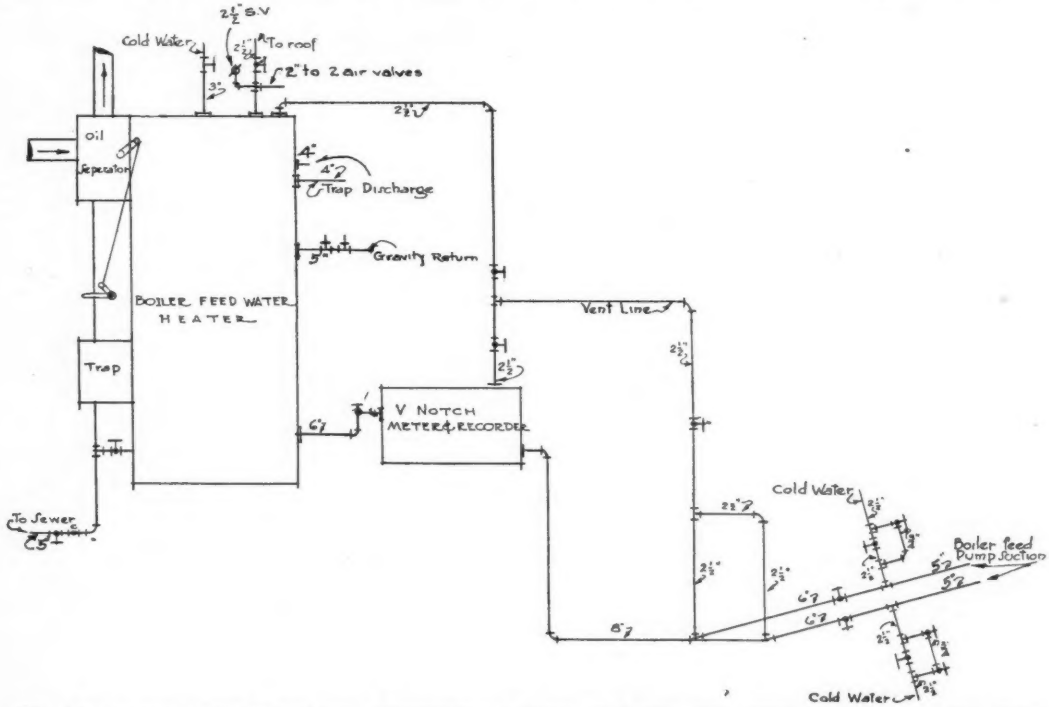
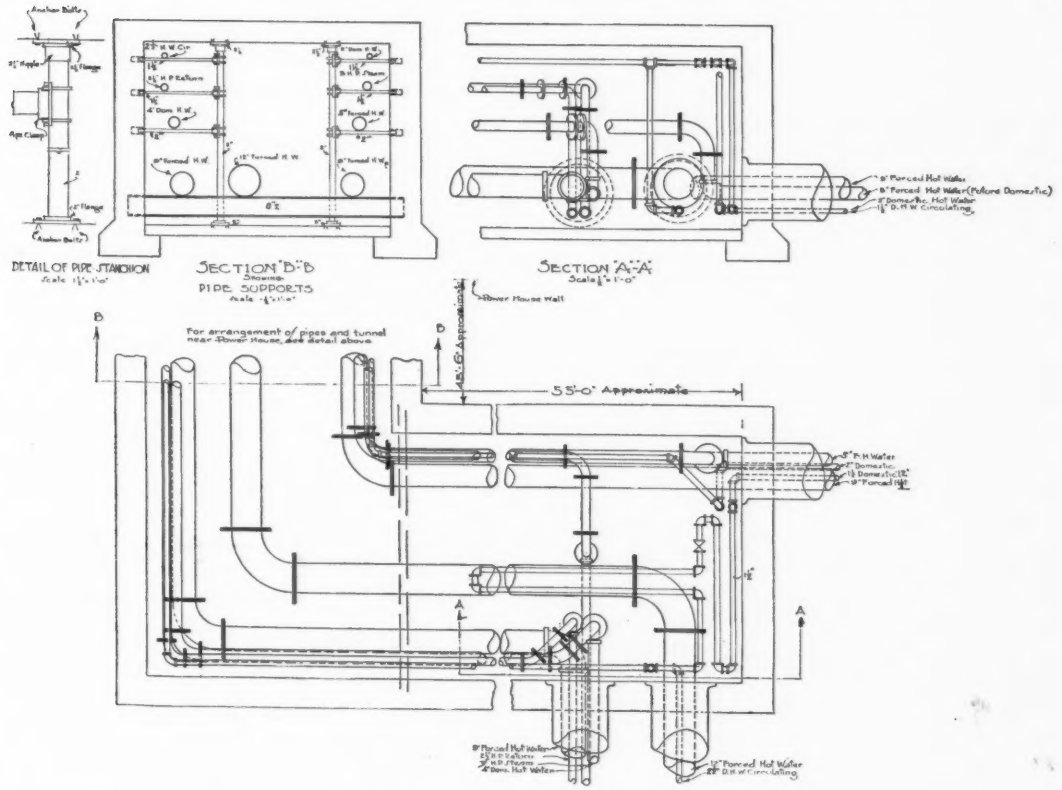


DIAGRAM OF CONNECTIONS BETWEEN FEED WATER HEATER, FEED PUMPS, ETC.

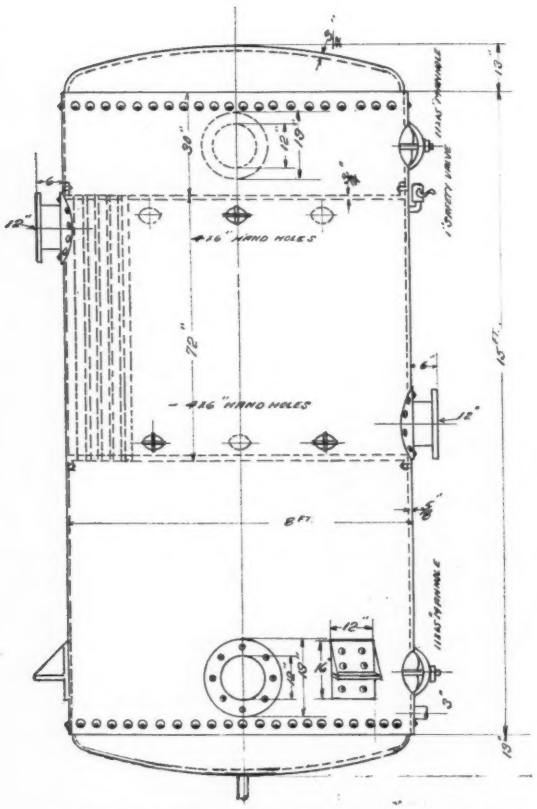


PLAN OF PIPING IN TUNNEL CHAMBER "A"
Scale ½"=1'-0"

PLAN OF PIPING IN TUNNEL, CHAMBER A

PLAN OF PIPES NEAR POWER HOUSE PART OF CHAMBER "A"

PLAN OF PIPES NEAR POWER HOUSE, PART OF CHAMBER A.



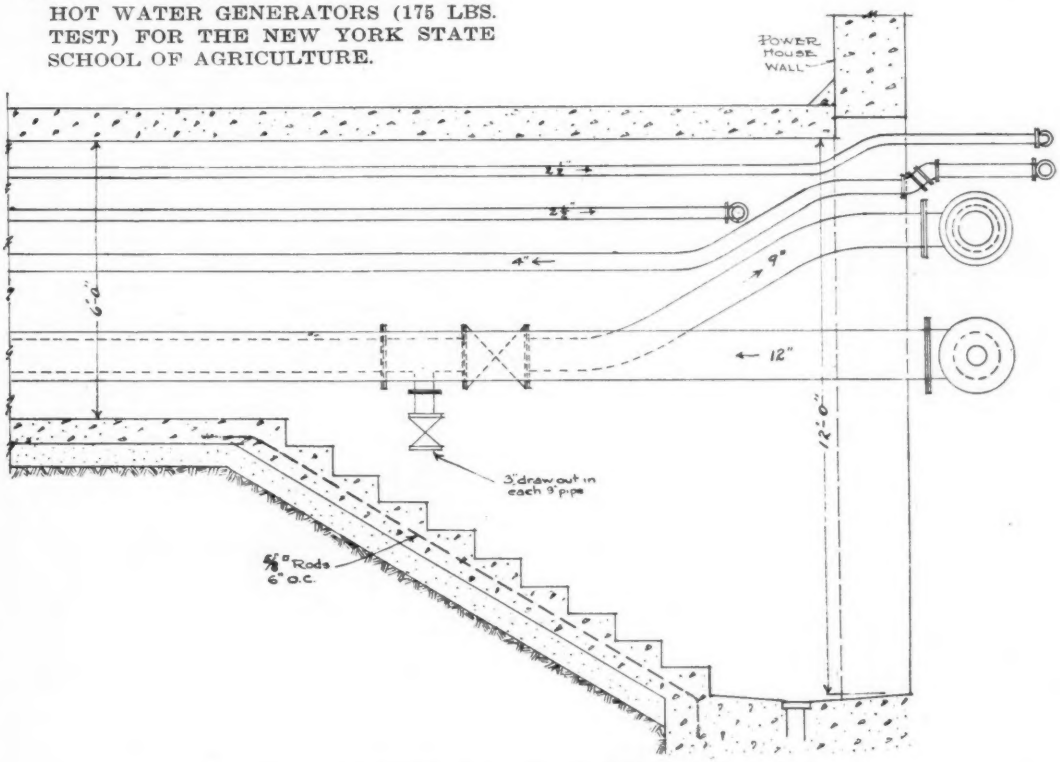
DETAIL DRAWING OF SIMS FORCED HOT WATER GENERATORS (175 LBS. TEST) FOR THE NEW YORK STATE SCHOOL OF AGRICULTURE.

each heater. These heaters are so connected that either heater can be supplied with exhaust steam and, in addition, one heater can be used as a primary heater, being supplied with high pressure steam, while the other is being used as a secondary heater, and supplied with low pressure exhaust steam. Presumably during mild weather, both heaters will be supplied with low pressure steam.

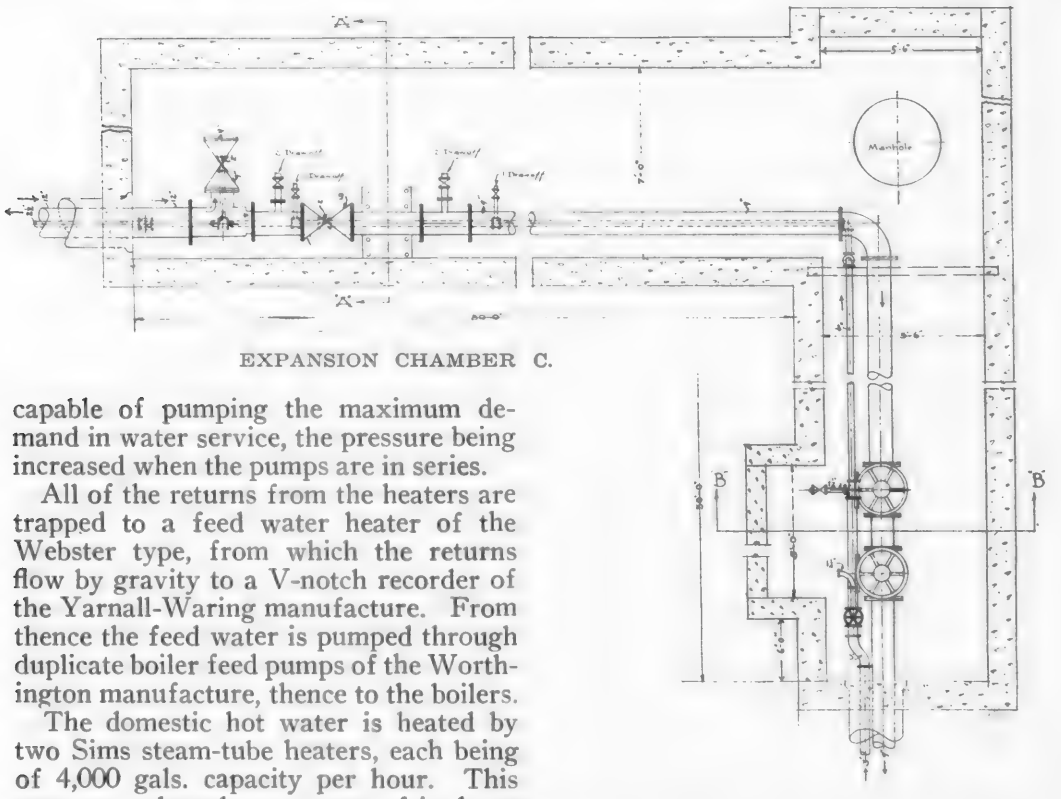
There are also connected to the forced hot water main two expansion tanks, each consisting of a steel tank 7 ft. 6 in. in diameter by 13 ft. high.

The heaters and expansion tanks are designed for a shop test of 175 lbs. pressure and a working pressure of 80 lbs. per square inch.

Circulation is to be maintained in the hot water heating mains by two direct-connected centrifugal pumps, each pump capable of discharging 2,500 gals. of water per minute against a head of 20 lbs. per square inch. Each pump is direct-connected to a steam turbine. The pumps are so connected that they can be operated in series or independently and are



ELEVATION OF PIPES AT POWER HOUSE, CHAMBER A.

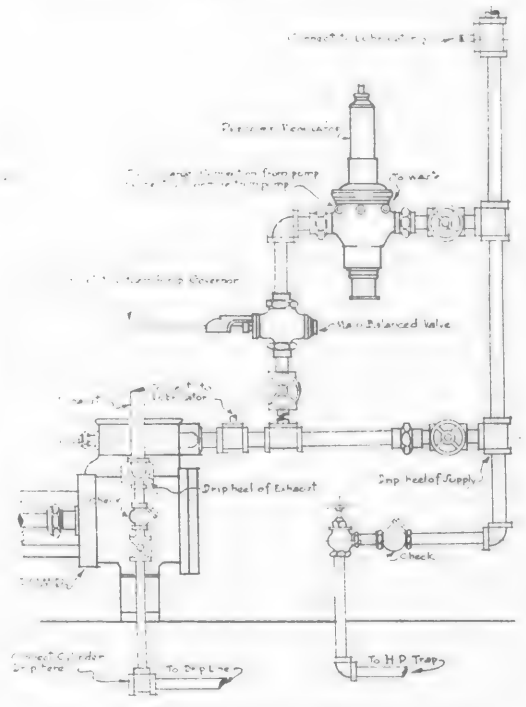


EXPANSION CHAMBER C.

capable of pumping the maximum demand in water service, the pressure being increased when the pumps are in series.

All of the returns from the heaters are trapped to a feed water heater of the Webster type, from which the returns flow by gravity to a V-notch recorder of the Yarnall-Waring manufacture. From thence the feed water is pumped through duplicate boiler feed pumps of the Worthington manufacture, thence to the boilers.

The domestic hot water is heated by two Sims steam-tube heaters, each being of 4,000 gals. capacity per hour. This type was selected on account of its large water capacity. So as to properly circulate the domestic hot water, there were installed two duplicate centrifugal pumps, direct-connected to motors, each being of 40 gals. per minute capacity, against a head of 10 pounds per square inch.



DETAIL OF SPEED PRESSURE REGULATOR.

METER INSTALLATION.

So as to keep track of the costs of operation of this plant and to properly distribute same, the following meters were installed:

One Venturi meter, manufactured by the Builders' Iron Foundry, to measure the amount of water pumped through the forced hot water heating system.

Two tempearture recording meters, one on the flow and the other on the return of the forced hot water heating mains.

One cold water meter measuring water supply to the domestic hot water heaters.

One cold water meter on make-up feed water connected indirectly at the boiler feed pumps.

One cold water meter for make-up cold water supplied to the feed water heater.

One outdoor temperature recording meter.

One steam recording meter of General

Electric Company's make, connected to the high pressure steam main supplying steam to the engine room main.

A similar meter is located on the high pressure steam header connected to the pump room apparatus.

There are also installed indicating steam flow meters on each boiler, together with steam recording pressure gauges connected to the high and low pressure mains.

Indicating thermometers were located at various points in the forced hot water heating main and boiler feed supply. Platform scales for weighing the coal delivered to the boiler room have also been installed.

Although the operating cost of such a plant will be somewhat higher for a number of years, due to a large number of pieces of apparatus being under partial load until the institution is finally developed, it is reasonable to expect that this plant in operation can be run economically and also that reliable information will be obtained, which will form the basis for the design of future plants.

All of the work is being installed by Albert Winternitz, heating contractor, New York City, and will be in actual operation by November 15. The contract for the power house equipment, together with that portion of underground heating mains at the present time being installed is $103,300.

Undoubtedly this is one of the first institutions of its kind in which the ultimate number of buildings have been planned for, so that the buildings and equipment now being installed will form a part of the final scheme and will not have to be replaced or removed at some future date.

It is noticeable also that the heating, contract for the present institution is approximately 25 per cent. of the total present cost, it being considered advisable to install the mechanical portion of the institution at the present time, particularly, as much as possible of the underground mains, so that the grounds would not have to be disturbed at a future time.

New Pipe Chart and Tables Based on Square Feet of Radiation

FOR USE IN DETERMINING SIZES OF STEAM SUPPLY MAINS AND BRANCHES FOR LOW PRESSURE STEAM HEATING SYSTEMS.

BY T. W. REYNOLDS.

Tables giving the capacity of steam supply mains and their branches are usually computed for the weight of steam in pounds per minute, with the initial pressure far in excess of that required for ordinary low pressure steam heating mains. The size of pipe required for varying amounts of radiation and other variables is seldom given directly in most formulae. As this is usually the result desired, it follows that the solution must be worked out backwards by a hit or miss method from formulas giving the amount of radiation or weight of steam supplied for any pipe size or other variable.

Also to compute or modify such tables in conformance with the required conditions under which a heating system is to be operated, the calculations must of necessity involve considerable time and patience. The few tables published on this subject, rate the capacity of steam supply mains in square feet of radiation, but fail to give such essential details as the initial pressure, drop in pressure between the source and terminal of the main, or the basic formula upon which the tables were computed, thereby leaving the user in more or less of a quandary as to the reliability of the table in question. Furthermore, it would be almost impossible to calculate a set of tables to suit any possible case that might arise.

In order to overcome the above difficulties the following tables and chart were computed, which may be of service to others having like difficulties.

THE FORMULA USED.

The formula used was one given by Professor R. C. Carpenter in the Trans.

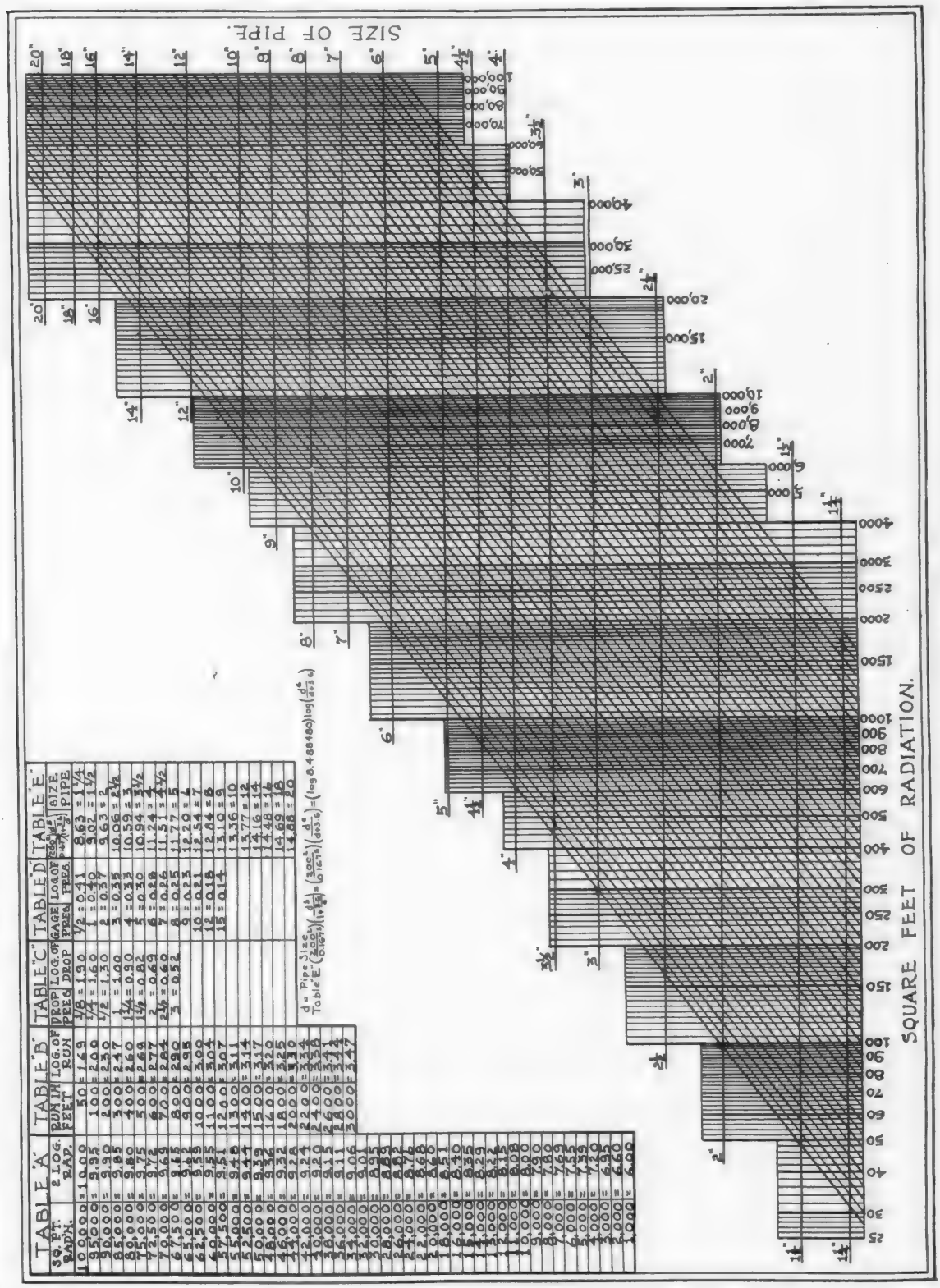


TABLE "A"	
30 Ft. Radius.	Log. Rad.
100000	= 5.000
95000	= 4.978
90000	= 4.954
85000	= 4.929
80000	= 4.903
75000	= 4.875
70000	= 4.845
65000	= 4.813
60000	= 4.778
55000	= 4.740
50000	= 4.699
45000	= 4.653
40000	= 4.602
35000	= 4.544
30000	= 4.477
25000	= 4.398
20000	= 4.301
19000	= 4.279
18000	= 4.255
17000	= 4.230
16000	= 4.204
15000	= 4.176
14000	= 4.146
13000	= 4.114
12000	= 4.079
11000	= 4.041
10000	= 4.000
9000	= 3.954
8000	= 3.903
7000	= 3.845
6000	= 3.778
5000	= 3.699
4000	= 3.602
3000	= 3.477
2000	= 3.301
1000	= 3.000

TABLE "B"	
Run in Feet	Log. of Run
50	= 1.69
100	= 2.00
200	= 2.30
300	= 2.47
400	= 2.60
500	= 2.69
600	= 2.77
700	= 2.84
800	= 2.90
900	= 2.95
1000	= 3.00
1100	= 3.04
1200	= 3.07
1300	= 3.11
1400	= 3.14
1500	= 3.17
1600	= 3.20
1800	= 3.25
2000	= 3.30
2200	= 3.34
2400	= 3.38
2600	= 3.41
2800	= 3.44
3000	= 3.47

TABLE "C"	
Drop in Feet	Log. of Drop
1/8	= 1.90
1/4	= 1.60
1/2	= 1.30
3/4	= 1.00
1	= 0.90
1 1/4	= 0.82
1 1/2	= 0.69
2	= 0.69
2 1/2	= 0.60
3	= 0.52

TABLE "D"	
Gage Pipes	Log. of Pipes
1/2	= 0.41
1	= 0.19
2	= 0.17
3	= 0.15
4	= 0.13
5	= 0.10
6	= 0.08
7	= 0.06
8	= 0.05
9	= 0.03
10	= 0.01
12	= 0.98
15	= 0.94

TABLE "E"	
Log. of Pipes	Size Pipe
8.63	= 1 1/4
9.03	= 1 1/2
9.63	= 2
10.06	= 2 1/2
10.52	= 3
10.94	= 3 1/2
11.24	= 4
11.51	= 4 1/2
11.77	= 5
12.20	= 6
12.54	= 7
12.84	= 8
13.10	= 9
13.36	= 10
13.77	= 12
14.16	= 14
14.48	= 16
14.69	= 18
14.88	= 20

d = Pipe Size.
Table "E" $(\log 2.06^{5}) / (\frac{d^{5}}{(2.067)^{5}}) = (\log 6.486400) \log (\frac{d^{5}}{(2.067)^{5}})$

NEW RADIATION CHART AND TABLES.

A. S. M. E. Vol. XX, which is similar to an equation given by Babcock in "Steam" and repeatedly referred to by various authors.

$$(1) \qquad d = 0.167 \sqrt[5]{\frac{W^2\left(1+\frac{3.6}{d}\right)L}{P^D}}$$

In which d = internal diameter of pipe in inches.

W = weight of steam in pounds

L = length of pipe in feet.

P = the difference between the initial pressure and final pressure at ends of main or total drop in pressure.

D = density or weight of steam per cubic foot at given initial pressure.

It is assumed that 1 sq. ft. of direct radiation under standard conditions will condense *0.3 lbs. of steam per hour, which is considered by many heating engineers as conservative and well within the limits of average practice, particularly where a good covering is applied to all mains, by which a saving of 80% of the heat otherwise lost is made.

$$(2)\ W = 0.3\ R \text{ per hour or } W = \frac{R}{3.33 \times 60}$$

$\frac{R}{200}$ per minute.

Substituting equation (2) in equation (1) and transposing we have

$$3) \quad \frac{R^2 L}{P^D} = \left(\frac{200^2}{0.167^5}\right)\left(\frac{d^5}{1+\frac{3.6}{d}}\right) = \left(\frac{200^2}{0.167^5}\right)\left(\frac{d^6}{d+3.6}\right) = (\log.\ 8.488480)\log\left(\frac{d^6}{d+3.6}\right)$$

A convenient solution for equation (3) may be obtained by means of logarithms.

$$(4) \qquad 2\log R + \log L + \log\frac{1}{P} + \log\frac{1}{D} = (\log\ 8.488480)\log\left(\frac{d^6}{d+3.6}\right)$$

or by using the accompanying tables in which all reasonable values have been computed. In place of the above variables in equation (4) we have

Table "A" + Table "B" + Table "C" + Table "D" = Table "E"

or one may select from Table "E" the largest commercial pipe size between which falls the summation of the values given in Tables "A," "B," "C" and "D," for the corresponding required conditions of the heating system.

DATA GIVEN IN THE TABLES.

In further explanation of the above, the tables give the values to be used which correspond to the required conditions and in the selection of the desired size of main. Thus: Table "A" gives the corresponding values for the maximum capacity of the main in square feet of direct radiation, Table "B" gives the corresponding values for the length of main or branch in feet, Table "C" gives the corresponding values for the drop in pressure in pounds per square inch, Table "D," the corresponding values for the initial or gauge pressure and Table "E" the corresponding values for the commercial pipe size.

The use of these tables does not require logarithms, steam tables or a long tedious process of solving a complex question.

HOW TO USE PIPE CHART.

The sizing of the various pipes for a steam heating system in large buildings is often done on the basis of a certain predetermined initial pressure and drop in pressure, using a length of run equal to the distance from the source or boiler to the farthest terminating point which is usually on the highest floor. For such conditions use may well be made of the accompanying chart.

As an example, assume 70,000 sq. ft. of radiation, 1,000 ft. run, 1 lb. drop and 3 lbs. initial gauge pressure. From the tables select from Table "A," opposite 70,000, the log 9.69; from Table "B," opposite 1,000, the log 3.00; from Table "C," opposite 1, the log 1.00; and finally from Table "D," opposite 3, the log 0.35. The summation of these logs is the log 14.04, and the nearest log selected from Table "E" is 14.16. Opposite this is the required pipe size, namely 14 ins.

Referring to the chart, follow the line extending at an angle of 45° from the pipe size, 14 ins., to the various intersections of this line with the vertical lines

*Including allowance for condensing capacity of distributing mains within the building.

denoting square feet of radiation. From these intersecting points are lines projected horizontally across the chart which indicate the required pipe size for the given conditions.

For example, follow the vertical line upward from 50,000 sq. ft. of radiation to its intersection with the 45° line extending from the point opposite 14 ins. The nearest horizontal line to the point of intersection is the one denoted by 12 ins., which is the size of pipe required to supply 50,000 sq. ft. of radiation for the same drop in pressure, initial gauge pressure, and length of run as assumed for the 14-in. pipe. In this way all mains, risers and branches for the heating system of a large building may be quickly and conveniently sized.

New Observations on Ventilation

According to orthodox views of architects, ventilating engineers and hygienists, as expressed by O. W. Griffith in an article in *The Medical Officer* (London), there are three points which must be strictly observed:

1. To provide sufficient cubical space per person, and a sufficient renewal of the air to insure its chemical purity.
2. To keep the temperature steady at about 60° F.
3. To keep the relative humidity at 75% or thereabouts.

Mr. Griffith was referring particularly to the conditions that would have to prevail in England after the present war, for he said, "when the young fellows in Kitchener's army return to civil life, they will demand healthier conditions than they formerly experienced in overheated factories and badly ventilated offices."

"Now these three cardinal points," added Mr. Griffith, "are shrouded in mystery, and though they are quoted in books on housing, ventilation, on hygiene and even on physics, one never finds a reference to any experimental facts in support of them, . . . Every attempt to discover poisons—organic or inorganic—in the air of occupied rooms under normal conditions has failed.

"As our experience widens, our knowledge of phenomena deepens, though now and again a genius appears before his time, has a vivid glimpse of the truth of things, and proclaims what he sees to an unheeding world. It is nearly a hundred years since Dr. Haberdeen—a medical man—in a short communication to the Royal Society, pointed out that the reading of an ordinary thermometer is no criterion of comfort, which really depends on the rate of cooling of the body. He advocated, as a test, warming the thermometer to about 100° F., and then determining the time of its cooling through one degree in the neighborhood of the temperature of the body. This rate of cooling he took to be the proper indication of the state of the atmosphere. His fellows gave his idea a decent burial in the transaction of the Royal Society—and his work was forgotten. But it has recently re-incarnated in the mind of Dr. Leonard Hill, who independently rediscovered it and extended it to the testing of the moisture in the air as well. The instrument adapted for this purpose is called the Kata-thermometer.*

"After a long and elaborate research conducted by Drs. Hill and Flack and myself, the complex part which temperature, humidity and movement of air play has been determined. Within a certain range, and keeping a proper balance between them, all three can be varied without affecting the pleasantness of the conditions. The movement of the air is, of course, more readily controlled than temperature and humidity, and that is really, I suppose, why the 60° F. and 75% humidity were fixed as standards. But it is important to notice that no combination of degrees of temperature and moisture can produce comfortable conditions in absolutely still air. Herein therefore comes the paramount importance of ventilation. Gentle varying air motion is stimulating to the skin—this is the prosaic physiological equivalent of the popular phrase: "Variety is the spice of life." On a beautiful spring or early summer day the radiant heat of the sun keeps the ground warm around our feet, and

*This instrument was described in the September, 1915, issue.

the soft, gentle, refreshing breezes circulates in eddies about the body, keeping the head cool and stimulating the nerve endings in the skin. These latter are like so many little telephone exchanges, which, when thus "rung up," call into vital activity all parts of the system. The kata-thermometer enables one to determine when this state of affairs obtains. It has the advantage that from its readings—taken in a few minutes—one can not only test the degree of comfort of the air, but one can also measure the humidity or the vapor pressure and the velocity of the eddies. For preserving and registering a continuous record of the comfort factor, Dr. Hill and the writer have invented an automatic electrical apparatus, called the Caleometer.

"Our observations show that to maintain the atmosphere of a room comfortable while the degree of moisture is going up—as it is liable to do when a number of persons are present—the temperature must be lowered, or the movement of the air increased. Since, however, overcrowding causes both moisture and temperature to increase, the necessity for more rapid air movement becomes greater.

"In the designing of houses therefore the size of the apartment must be such that a gentle air motion (as distinguished from an unpleasant draft) is sufficient to keep the air temperature and moisture from rising excessively and to preserve a standard kata-thermometer reading. To insure this the apartments must be roomy and lofty. The point, however, can only be settled by direct observation. The question of artificial heating complicates the matter enormously, but there are some points which the kata-thermometer has decided for us.

RATE OF COOLING SHOULD BE GREATER AT HEAD LEVEL THAN AT FLOOR LEVEL.

"It is absolutely essential that the rate of cooling should be greater at head level than at floor level. One of the chief disadvantages of the coal fire is that it sometimes inverts this arrangement. There is often a cold draft along the floor on account of the drawing power of the chimney. Draft excluders at the bottom of the door, or a small mat outside it, are the usual means adopted to cure this defect, and even when it is not completely eliminated, one can always keep comfortable by placing one's feet on the fender, so as to receive the full benefit of the radiation from the fire.

"In olden times the Chinese and the Romans kept their fire burning by a downward draft, and, I believe, the chimney passed under the floor. This, in principle, was an excellent arrangement. Heating by steam radiators (which are not radiators), and all similar ways of creating convected heat are thoroughly bad, because they produce slower cooling at head level as compared with foot level. Meanwhile we must rigorously test every new system and every new scheme. We must determine with precision the defects of the houses we have already got. The kata-thermometer helps to do this."

Can We Locate the Neutral Zone in Heated Buildings?

By J. J. Blackmore.

(Presented at the semi-annual meeting of The American Society of Heating and Ventilating Engineers, at Atlantic City, Sept. 16-17, 1915. The data in this paper formed the substance of a lecture in a course on heating and ventilating given by Arthur K. Ohmes to a class of Columbia University students.)

A study of the conditions created by the application of artificial heat to our buildings presents some very interesting and fascinating problems. Some of these problems are very elusive and not easily solved.

The conditions thus created, however, are due to the working of physical laws and if these laws are studied and understood, the reason for the changed conditions is readily appreciated.

The location of the neutral zone is one of these problems and its location is important on account of the many disturbances which may be created in the design and operation of heating and ventilating plants; especially is this the case in a large building of many stories in height.

PHYSICAL FACTS INVOLVED.

In cold weather, the air contained in a heated building, being of a higher temperature than the outside, is much lighter than the air surrounding it, and being lighter, it has a tendency to rise in accordance with the laws of gravitation. This body of light air is kept from rising by the walls and roof of the building, being thus prevented from rising, pressure is exerted against the ceiling and upper part of the walls to a considerable extent. In a large building, say 200 ft. by 200 ft. by 125 ft., containing 5,000,000 cu. ft., the difference between the weight of the inside air at 70° F., and the same quantity outside at zero is 5,000,000 × (0.0864 — 0.075) = 57,000 lbs. or 28.5 tons, 0.0864 being the weight in pounds of a cubic foot of dry air at zero temperature and 0.075 being the weight in pounds of a cubic foot of dry air at 70° F.

As an example, we will consider the conditions in a room as shown in Fig. 1, which is supposed to be air tight and uniformly heated to 70° F. when the outside air is at zero. The room having an opening at bottom the atmospheric pressure would be equalized at this opening.

The weight of a column of air one foot square and 50 ft. high at 70°, would be 50 × 0.075 = 3.75 lbs., and a similar column of air at zero would weigh 50 × 0.0864 = 4.32. The difference being 0.57 lbs. per square foot.

The warm air is, therefore, pressed

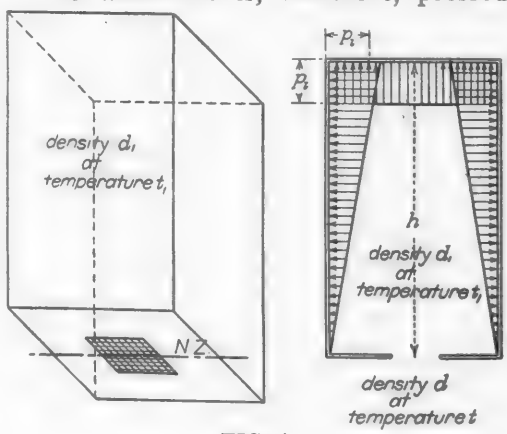


FIG. 1.

towards the ceiling by the greater density of the external air pressure exerted through the opening in the bottom of the room, the difference in weight or density of the two bodies is manifested by pressure against the ceiling and walls of the room. This difference of pressure would create a velocity equal to approximately 22 ft. per second, at the above temperatures. $V = \sqrt{\frac{2GP}{Y}}$ or $V = \sqrt{\frac{2 \times 32.16 \times 0.57}{0.075}} = 22$. In which G is the acceleration due to gravity, P the pressure in pounds per square foot, and Y the weight of a cubic foot of air at 70° F. in pounds.

COMPARISON WITH IMAGINARY U TUBE.

Comparison may be made between conditions in such a room and an imaginary U tube of large dimensions as shown in Fig. 2. Assuming that the U tube is 50 ft. high, filled on one side with

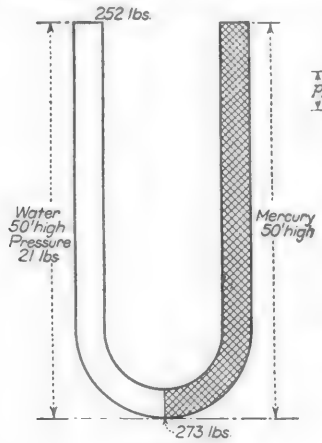


FIG. 2.

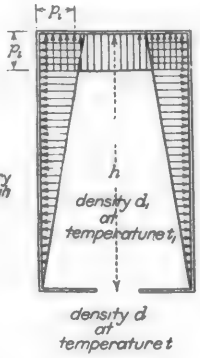


FIG. 3.

water and the upper end of the tube on that side is closed tight. Into the other side is introduced the same volume of mercury. The column of water 50 ft. high would exert a pressure of about 21 lbs., at the base of the tube, while the mercury would exert a pressure of 273 lbs., at the same point. In this case the pressure due to the mercury would force the water up against the closed end of the tube equal to a pressure of 273 — 21 = 252 lbs.

The different pressures in a room like that shown in Fig. 1 may be represented by the illustration Fig. 3, and the pressure at the top of this room as shown by the example of the U tube would be $Pi = h\ (d - d_1)$ in which

Pi = pressure above the atmosphere;
d = density of the outside air
d_1 = density of inside air.

Having in mind that one cubic foot of air at zero weighs 0.0864 lbs. per cubic foot and that for other temperatures the density of the air is in direct proportion to the absolute temperature, we can express the equation with approximate accuracy in temperatures to obtain the difference in density between equal volumes of the inside and outside air, as follows; for a room 50 ft. high.

$$Pi = h\left(\frac{0.0864 \times 460}{460 + t}\right) - \left(\frac{0.0864 \times 460}{460 + t_1}\right) \text{ or } Pi = 50\left(\frac{0.0864 \times 460}{460 + 0}\right) - \left(\frac{0.0864 \times 460}{460 + 70}\right)$$

= 0.57 lbs. per square foot.

If this same room with the same conditions as before had one opening at the top instead of the bottom as in Fig. 4, and if the atmospheric pressure equalized with the room pressure, at this point, the difference in weight of the two columns of air would be the same as in the case with the opening at the bottom, but the external air, being heavier, would press on the under side of the room with greater force because the outside air is of greater density than that within. If an opening were made in the bottom, the room would appear to be under a vacuum, for the heavier air would at once flow through the opening into the room.

We have designated the pressure exerted against the inside walls as Pi, and in a similar manner we will designate the pressure against the outer surface of the walls as Pe, then the equation to

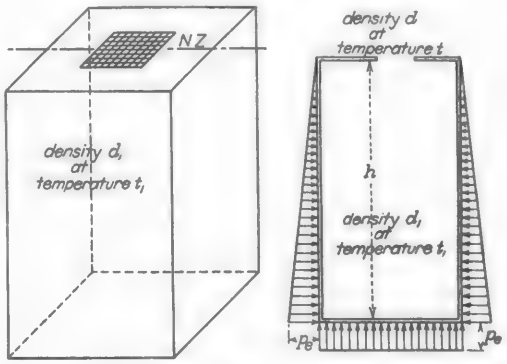


FIG. 4.

obtain the difference in weight or pressure by the density is:

$Pe = h\ (d - d_1)$, or to obtain it from the temperature it will be:

$$Pe = h\left(\frac{0.0864 \times 460}{460 + t}\right) - \left(\frac{0.0864 \times 460}{460 + t_1}\right)$$

The conditions illustrated in these two extreme examples show clearly the fact that different pressures above or below the outside pressures must exist

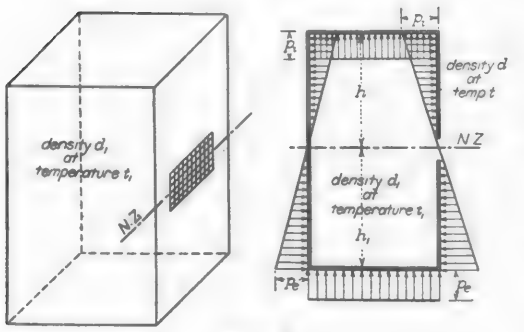


FIG. 5.

in a room or building when the contents are heated to a temperature above that of the external air.

In a similar manner if a room or building is cooled in the summer months the reverse of these conditions will obtain.

Additional openings into rooms will produce different conditions, also a change in the location of the openings into the room will shift the location of the neutral zone, as will be shown in the following examples.

In Fig. 5, with an opening in the side of the room the neutral zone will be slightly above the center of the opening and the following formula will apply:

$Pi = h_1 + h\ (d - d_1)$ to obtain the pressure by density.

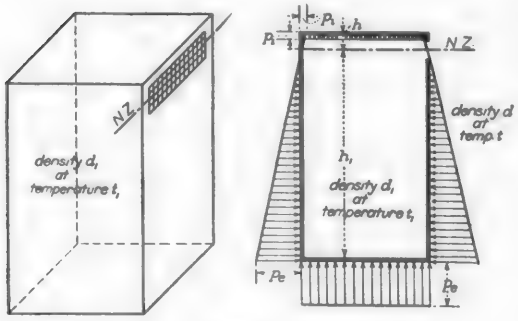


FIG. 6.

$$Pi = h_1 + h\left(\frac{0.0864 \times 460}{460 + t}\right) - \left(\frac{0.0864 \times 460}{460 + t_1}\right)$$

to obtain pressure by temperature.

$Pe = h_1 + h\ (d - d_1)$ to obtain the pressure by density.

$$Pe = h_1 + h\left(\frac{0.0864 \times 460}{460 + t}\right) - \left(\frac{0.0864 \times 460}{460 + t_1}\right)$$

to obtain pressure by temperature.

EFFECT OF NEUTRAL ZONE IN TOILETS, KITCHENS, ETC.

Fig. 6 illustrates the location of the neutral zone as it would be in the case

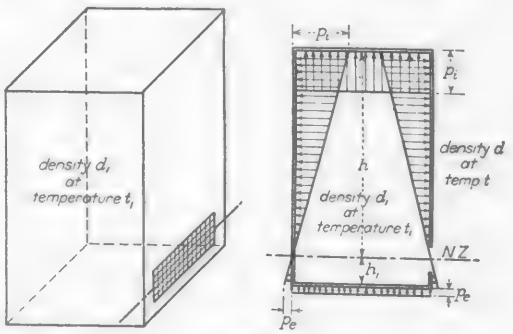


FIG. 7.

of toilets, kitchens, or other rooms generating odors which necessitate air opening for ventilation near the ceiling. In such a room a strong draft will be noticed when doors are opened into it. The same formula applies as given for Fig. 5.

Fig. 7 illustrates the location of the zone in a room with an opening near the floor, as would be the case if a room was heated by the indirect method, if the register was located in a similar place. The opening of a door into such a room would occasion little, if any, draft. The same formula applies as given for Fig. 5.

Fig. 8 illustrates a room with an inlet and outlet which equalize the conditions and brings the zone to a point just above the center. Of course, an accelerated draft in the upper opening would raise

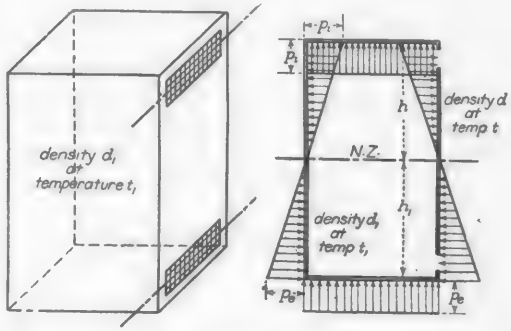


FIG. 8.

the zone to a higher plane and a partial closing of the same opening would lower it to balance the changed conditions. The same formula applies as given for Figure 5.

The foregoing figures illustrate the fact that the neutral zone may be located at any height in a closed air-tight room, by changing the position of an opening to the outer air. It is also possible to locate the neutral zone at a distance above the ceiling or below the floor of a room by an arrangement of outlets as shown in Figs. 9 and 10.

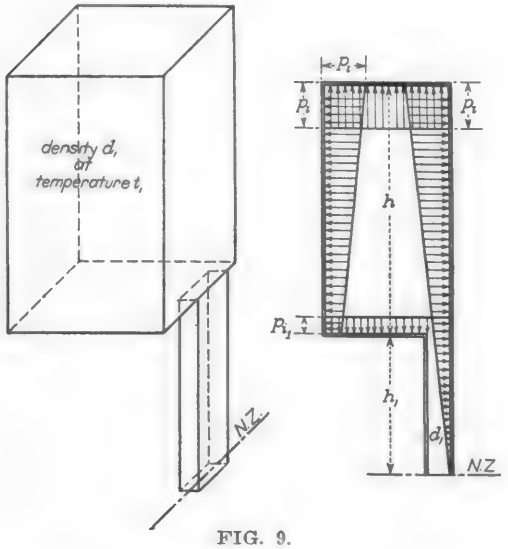


FIG. 9.

Fig. 9 illustrates a means of locating the zone at a point below the floor line. A floor register and a ventilating pipe with a strong draft would produce this condition:

$Pi = h_1 + h\ (d - d_1)$ to obtain the pressure by density.

$$Pi = h_1 + h \left(\frac{0.0864 \times 460}{460 + t}\right) - \left(\frac{0.0864 \times 460}{460 + t_1}\right)$$

to obtain the pressure by temperature, being the pressure at ceiling line inside.

$Pi_1 = h_1 + h\ (d - d_1)$ to obtain the pressure by density.

$$Pi_1 = h_1 + h \left(\frac{0.0864 \times 460}{460 + t}\right) - \left(\frac{0.0864 \times 460}{460 + t_1}\right)$$

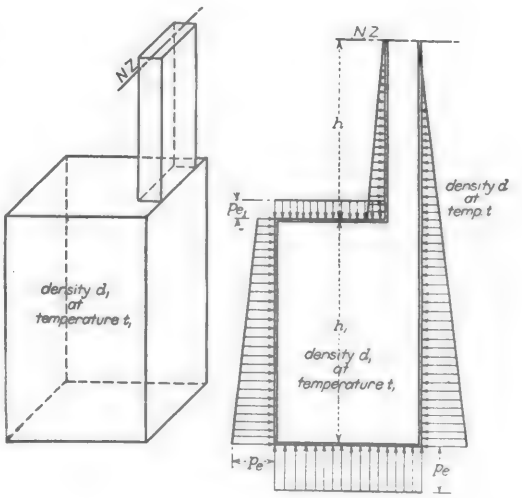


FIG. 10.

to obtain the pressure by temperature, being the pressure at floor line inside.

Fig. 10 illustrates a condition the reverse of those in Fig. 9, a ventilating pipe from the ceiling would lift the neutral zone to a point above the ceiling about as shown.

$Pe = h_1 + h\ (d - d_1)$ to obtain the pressure by density.

$$Pe = h_1 + h \left(\frac{0.0864 \times 460}{460 + t}\right) - \left(\frac{0.0864 \times 460}{460 + t_1}\right)$$

to obtain pressure by temperature, being the pressure acting from the outside on the floor line.

$Pe_1 = h_1 + h\ (d - d_1)$ to obtain the pressure by density.

$Pe_1 = h_1 + h$

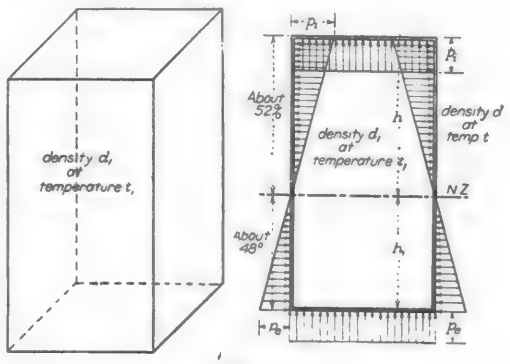


FIG. 11.

$$\left(\frac{0.0864 \times 460}{460 + t}\right) - \left(\frac{0.0864 \times 460}{460 + t_1}\right)$$

to obtain pressure by temperature, being the pressure acting from the outside on the ceiling line.

In an air tight room as shown in Fig. 11 the neutral zone would be 2% below the center, that is, it would be located at about 48% above the floor line.

EXAMPLES ALL BASED ON STILL AIR AND TIGHTLY-SEALED ENCLOSING SURFACES.

Again the author calls attention to the fact that all these examples are based on a condition of still air and tightly sealed enclosing surfaces, a condition which never exists in our buildings because the walls, ceilings and floors are porous and the windows and doors are surrounded by many cracks and crevices through which the air leaks in or is forced out, as may be determined by their location in relation to the neutral zone.

This condition may be explained as follows: There is always a place or plane inside a room or building that will be equal in pressure to that of the air surrounding it on the outside. This plane has been rightly called the "neutral zone." Its exact location in a room or building depends on the relative leakages at the ceiling or upper part of the walls or at the floor and lower part of the walls and under ordinary conditions in still air its location will be slightly below the central horizontal plane of the room. It will be understood, however, that if the lower portion of a building has more openings through which air can leak in than the upper portion, the zone would be raised somewhat higher and the reverse would be the case if more openings were located in the upper part.

No doubt the location of the neutral zone of an entire building will vary greatly with its size and shape, with the number and size of the windows and doors and their relative location, etc.

EFFECT OF SHAPES OF BUILDINGS ON NEUTRAL ZONE.

We will now consider the effect on the neutral zone of the shape of some noted buildings in New York City which, for the purpose of illustration, we will assume are all forty stories in height. The neutral zone will prove to be at an approximately different level for each building, if the location of it is figured from the foregoing data.

The location of the neutral zone in a building of the same floor area all the way up, as shown in Fig. 12, will be about the nineteenth floor. A building, as shown in Fig. 13, with a central tower above the twenty-fifth floor would have the neutral zone at a lower level, and in this case it would be somewhere about the sixteenth floor. A building, as shown in Fig. 14, with a tower above the eighteenth floor would have a still lower neutral zone, and in this case it would be approximately at the twelfth

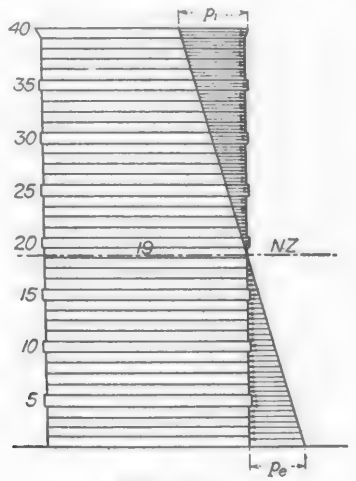


FIG. 12.

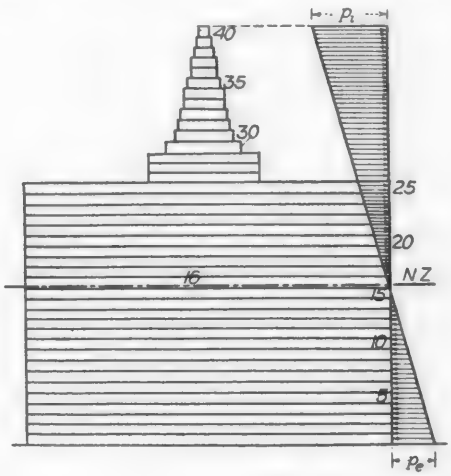


FIG. 13.

floor. In the case of the building illustrated in Fig. 15, which has a tower extending above the ninth floor, the neutral zone would be lowered to somewhere about the ninth floor, or practically at the roof line of the main building.

The practical importance of these illustrations would seem to be that they show that a rectangular or square building would have the greatest indraft and the least pressure at the top, whereas the tower building would have a less indraft per foot of surface, but a much greater pressure at the top of the tower.

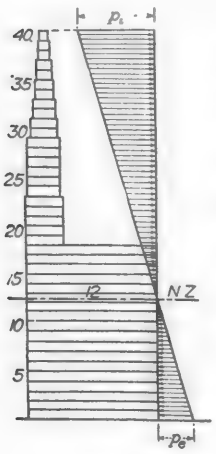


FIG. 14.

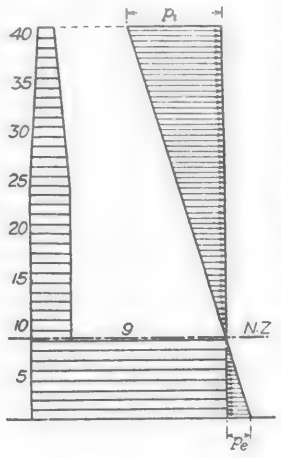


FIG. 15.

Anyone who has visited the top of a building like the Woolworth or Singer tower has probably noticed how difficult it is to close a door against the current of air flowing out from the top of such a building.

If we consider a tower building 750 ft. high and assume its neutral zone to be 300 ft. above the base, we would have (with a temperature of zero outside and 70° F. inside) an outside pressure of:

Pe = 300 (0.0864 — 0.075) = 3.42 lbs. per sq. ft. or 55 ft. per second, = 36 miles per hour and an inside pressure of:

Pe = 450 (0.0864 — 0.075) = 5.13 lbs. per sq. ft. or 66 ft. per second, = 45 miles per hour.

EFFECT OF HIGH WINDS ON INDOOR AIR PRESSURES.

Any high winds will effect these velocities as follows:

On the lower floors the leakages would be increased but on the upper the pressure would be counteracted because the tower presents a smaller surface to the wind.

It is, of course, understood that these studies on the subject of the neutral zone are considered with the building located in still air; wind velocities will change the location of the neutral zone, but such changes of location will not be material.

Poor or leaky construction in a building will materially affect the heat required to offset the loss occasioned by such construction, but such defects will not change to any great extent the location of the neutral zone. If more air leaks in below the neutral zone, a correspondingly larger amount will be forced out above the neutral zone.

Wind at a high velocity blowing against one side of a building may cause air to leak in to a larger extent on that side of the building on account of the excess pressure, in which case more air is forced out from the sheltered sides of the building which leaves the neutral zone not materially changed from what it would be in still air, but a larger amount of radiation would be needed on the windy side of the building to maintain a uniform temperature on the inside.

MORE RADIATION REQUIRED FOR SPACE BELOW NEUTRAL ZONE.

It will be seen from the foregoing that the radiation provided for the space below the neutral zone will need to be much in excess of that provided for the space above the neutral zone with a possible exception in the case of a top floor which is affected by the heat losses from the roof.

In a similar manner the neutral zone affects the ventilating system of a building. Its location determines the pressures in the building, and the pressures must be added or subtracted to or from the pressures under which the fans operate, whether the fans are placed in the basement or on the top floor of the building.

(*For discussion of this paper, see October, 1915, issue.*)

THE BUSINESS OUTLOOK.

II.

By Frank M. Huston,

Financial Editor of the Chicago Evening Post; Editor Rand-McNally Bankers' Monthly.

With the volume of our exports increasing by leaps and bounds and justifying an estimate by Washington of more than $3,716,200,000 for the fiscal year 1916 compared with $2,716,200,000 for 1915, there is ample assurance that there lies in this enormous strengthening of our financial position in the world's commerce sufficient reason for the expectation of a decided broadening in our industrial and commercial activity.

Already the barometer of industrial tendencies, the steel business has expanded to more than normal conditions. Mills are operating to a capacity beyond that regarded as possible prior to a few months ago. While the impetus for this broadening of activity came as a result of the abnormal export trade—orders for munitions and supplies made necessary by the war—yet our domestic steel business has returned to normal proportions, according to experts in that industry. The mills for weeks have been unable to take business for delivery during the early months of 1916, and the capacity of these big plants are being strained to the limit to care for business that is offering for the latter months of next year.

Money is accumulating so rapidly in our banks that it is becoming burdensome, and this excess of commercial funds and credit is already beginning to stimulate investment, despite the feeling of caution which the vast destruction of capital abroad in the war caused to manifest itself in the first year of the European conflict.

This country is forging to the front as the leading financial nation of the world. Today it is the center from which financial energy is spreading to Europe, and with the broadening tendency of economic power and civilization centering here the development of the next few years must necessarily afford an impetus for a broad expansion of business.

We are already lending credit to Europe, as is instanced by the credit loan of $500,000,000 to France and England. This is not a loan of money; it is in reality a loan of goods, such as grain and other foodstuffs and manufactured articles. It includes, of course, munitions, but Europe would have to buy munitions here whether we extended credit or not, but she might economize on many of her other purchases in this market and find other sources to supply her wants in the way of commodities other than munitions, were we to deny her the credit sought.

This extension of credit broadens our scope of activity. It gives our workingmen employment, our manufacturers a demand that is both profitable and stimulating. It is making this country, temporarily at least, the leader in the world's commerce, but it brings added responsibility, which will necessitate greater preparedness to protect our commerce and our business interests. All this means a broadening of industrial activity at home. It means additional buying power for the great industrial element of the country.

Nature has bestowed bountiful crops on our agricultural sections. One striking feature of this crop season had been the necessity of a progressive revision of estimates of our agricultural production. The latest available government estimates show, instead of a wheat crop slightly in excess of 900,000,000 bushels, the greatest wheat production in the history of any nation, a production in excess of 1,000,000,000 bushels. It shows a corn production nearly as great as that of 1912 and considerably in excess of 3,000,000,000 bushels. It shows a production of oats only slightly below a billion and a half bushels and other crops proportionately large.

Instead of our production of new wealth from the soil approximating around $10,000,000,000 it is necessary to revise these estimates because of the continuation of war prices for our surplus products. It is the demand for our surplus and the prices received for them that establishes the value of our crops, and there is reason to believe that an estimate of $11,000,000,000 for the new wealth created from the soil is not excessive. This means at least three times that amount of fresh credit.

Fundamental conditions were never better in this country for an expansion of trade and general business, the one retarding feature being the lack of confidence, which is attributable largely to uncertainty regarding the economic effect of war. But gradually the idea is gaining that the immediate effect of the war will not be as disturbing as the ultimate effect and that there will be an intervening period of great prosperity in this country. Soil conditions for next year are remarkably favorable. The soil is well soaked and any absence of rain is likely to be offset by the storage of moisture in the ground during the last two years.

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AS BEARING directly on the movement for improving the status of the engineer, the frank statements, in another column, made by Ernest McCullough before the Western Society of Engineers, in a recent talk on engineering societies in general and their attitude towards the young engineer, are well worth reading. Passing by the criticisms leveled at many of the accepted society methods, there are some constructive suggestions regarding the needs of the young engineer. The young engineer, said the speaker, looks to his society for scholarship, companionship and definite recognition. He is glad to attend a meeting where there is a lack of formality and perhaps an opportunity to mingle freely with older men who have made their mark. He wants to make acquaintances with men having like interests with himself and to feel that the society is more than an editorial body or an encyclopedia compilation of engineering facts—that is, it is composed of flesh and blood men who want to help him because of their knowledge of the trials and tribulations he is undergoing.

Among the definite recommendations was one urging the establishment by engineering societies of "service clearing-houses." On this topic the speaker arraigned all of the older engineering bodies. He pictured the engineer as a wanderer from job to job. When capital is active he is hard to find, but when dull times come and capital rests, the streets are full of technically-trained men out of work. The speaker maintained that there is a place for all and that it is the duty of the older and more successful engineers to take care of those not so successful.

When it comes to legislation for the technical man, the speaker endorsed the proposition requiring the registration of technical engineers with an examining board qualified to examine men in different specialties, so that the word "engineer" will possess a dignity comparable with the titles of the other learned professions. He also urged a wider latitude in connection with publicity efforts. "Throughout his life," he claimed, "the technically-educated man, the engineer, is at times a professional man, a technical employee and a business man. He must do some publicity work, and a society should not be hide-bound in what is to be considered proper means of publicity to be employed by individual members." Another effect mentioned of proper publicity work was that it would have the effect of sifting out desirable men from those not so desirable, the speaker claiming that it is because of improper publicity work that there are so many complaints to-day of unfit men enrolled as engineers.

In short, as a plain talk on engineering societies, the address was about as breezy a presentation as one could hope to find.

THE CONSULTING ENGINEER

The Consulting Engineer" is prepared to reply, in this department, to any questions which our readers may ask regarding problems connected with the design and installation of mechanical equipments of buildings.

CONDUCTED BY IRA N. EVANS, C. E.

53—Cause of Drop in Pressure in Pipes.

QUESTION: What causes the drop in pressure in a pipe conveying superheated steam, provided all the superheat is not lost when the steam reaches its destination? For instance, in a pipe carrying saturated steam the drop in pressure, we would say, was caused by the condensation or loss of latent heat; but in superheated steam, we have no loss of latent heat because it has not lost all of its superheat. Then what would cause the drop in pressure? This line is supposed to connect a boiler and engine.

ANSWER: The drop in pressure is due entirely to the velocity head and friction head whether the steam is superheated or saturated. The heat due to friction is all returned to the steam or, rather, there is no loss in heat content except from the radiation of the pipe. It should be treated as a gas or fluid flowing in a conduit.

The conditions of the steam at the end of the line is due to the loss of heat by radiation from the piping. If at the end of the line the heat remaining per pound is more than that of saturated steam at the final pressure, it is superheated; if it is less, the amount of steam condensed per pound will determine its quality or percentage of moisture.

As a rule, an approximate determination has to be made of the drop in pressure for a given discharge and size of pipe so as to find the average pressure in the run, to determine the weight per cubic foot to be used in the friction formula. The loss by radiation is determined, allowance being made for the efficiency of the covering, and the B.T.U. per pound of steam delivered due to the radiation loss. This is deducted from the B.T.U. per pound of steam at the initial pressure, which will give the B.T.U. per pound at the final pressure at the end of the line. Knowing the final pressure and the B.T.U. per pound, the condition of the steam can easily be determined from a steam table. In transmitting saturated steam, if the velocity is very high, with a great drop in pressure, the condition may be superheated at the end of the line in spite of radiation losses.

Where steam is condensed in a saturated line one-half the loss in B.T.U. is divided by the latent heat at the final pressure, as the capacity of the main is only reduced by one-half of the total amount. One-half of the radiation and condensation occurs before the one-half point in the main.

In long runs for heating mains it is often good practice to use a high pressure and small diameter main. With the high velocity and large drop in pressure the steam becomes superheated at the end of the main. This does away with any loss in condensation in transit and takes the place of a reducing valve at the power house as well as larger main under less pressure and drop.

The drop in pressure through the reducing valve is used for velocity in the first case. For example, we will assume a main 2,000 ft. long, 6 in. in diameter, and show what the discharge will be and its condition of pressure and temperature with an initial pressure of 75 lbs. gauge and 30 lbs. drop in pressure. We will then reduce the length of main to 200 ft. or 1/10th and determine the same points.

The loss in radiation will be, with 80% efficiency of covering and 3 B.T.U. per square foot per hour, with the ground temperature 40° F. and a steam temperature at the average pressure of 60 lbs. gauge. 6 in. pipe has 0.57 ft. of pipe per square foot of outside surface.

$\frac{2000}{0.566} = 3530$ sq. ft. surface. The temperature of steam at 60 lbs. gauge is 307.6° F.

$\frac{3530 \times 3 \times (308 - 40)}{3600} = 800$ B. T. U. per second, approximately.

800 × 20% = 160 B.T.U. per second lost in heat from the main under the maintained condition of pressure and flow.

The formula for drop in pressure, from Meiers' "Mechanics of Heating and Ventilation," is:

$$P_f = \frac{W}{144} \; 0.0257 \; \frac{V^{1.95}}{2\,g} \; \frac{1}{d^{1.2}}$$

In which

W = weight per cubic foot steam at the average pressure of 60 lbs. gauge.

V = velocity in feet per second.

P_f = friction loss in pounds per square inch.

2 G = 64.32 acceleration of gravity.

l = 2000 ft.

d = diameter in feet or 0.5.

We have now

$$30 = \frac{0.1721}{144} \times \frac{0.0257}{64.32} \times \frac{V^{1.95}}{(0.5)^{1.2}} \times 2000$$

clearing of arithmetical factors we have

$$V = \sqrt[1.95]{31411 \times (0.5)^{1.2}}$$

Log V = 2.1209466 = 132.1 ft. per second velocity.

The area of a 6-in. pipe = 29 sq. in. = 0.2 sq. ft. nearly. 132.1 × 0.2 = 26.4 cu. ft. of steam per second.

$$\text{Velocity head} = P_v = \frac{W}{144} \times \frac{V^2}{2g}$$

$P_v = (132.1)^2 \times 0.000018 = 0.31$ lbs. per square inch, which is negligible in this case.

The weight per cubic foot of steam for the discharge at 45 lbs. gauge pressure is 0.1394 lbs. per cubic foot. Then 26.4 × 0.1394 = 3.68 lbs. steam per second discharged.

160 ÷ 3.7 = 43.2 B.T.U. per pound of steam per second in radiation from the main. The total heat per pound of steam entering the main is:

At 75 lbs. gauge....1184 B.T.U. per pound.
At 45 lbs. gauge....1177 B.T.U. per pound.

Difference ..... 7 B.T.U.

The latent heat at 45 lbs. gauge is 915 B.T.U. The per cent. of moisture in the steam will be as follows: 43.2 — 7 = 36.2 B.T.U. condensed per pound. 36.2 ÷ 915 = 0.04 ibs. of steam condensed per pound delivered.

As one-half of the steam is condensed at the center of the main and the other half at the end, there remains the same cubic feet and capacity of the steam condensed under the conditions named.

The actual per cent of moisture per pound will be 0.04 ÷ (1 + 0.02) = 0.0392 lbs. moisture actually condensed per pound delivered. This will be of a quality of 96.08% at 45 lbs. pressure at the end of the line.

In case the pipe were 10,000 ft. long, the radiation would be five times more or 800 B.T.U. per second. Log V would be 1.762504 = 57.9 ft. per second. The area of the 6-in. pipe being 0.2 sq. ft., 57.9 × 0.2 = 11.58 cu. ft. steam per second.

Velocity head = $P_v = (57.9)^2 \times 0.000018$ = 0.06 lbs. The discharge at 45 lbs. pressure will be, at 0.1394 lbs. per cubic foot, 11.58 × 0.1394 = 1.614 lbs. per second.

The difference in heat per pound weight between the initial and final pressures, 75 lbs. and 45 lbs. gauge, is 7 B.T.U. per pound. The per cent. of moisture in the steam will be as follows, or the steam will be saturated with water as follows: 800 B.T.U. ÷ 1.6 = 500 B.T.U. per pound. 500 B.T.U. — 7 = 493 B.T.U. per pound delivered. 493 ÷ 915 = 0.54 condensed in pound per pound.

0.54 ÷ 2 = 0.27 lbs. of condensation. The percentage of water will then be 0.27 ÷ (1 + 0.27) = 21.3% water. 21.3% × 1.614 lbs. = 0.344 lbs. per second. The net discharge is saturated steam at 45 lbs. will be 1.27 lbs. per second.

If the pipe were 200 ft. long, instead of 2,000 ft., the radiation would be reduced by 10 or 16 B.T.U. per second per pound, instead of 160, as before. The velocity would be increased as follows: the factor in the former case, 31411, would become 314110. This is the only change, due to the length.

$$V = \sqrt[1.95]{314110 \times (0.5)^{1.2}}$$

Log V = 2.63377 = 430.3 ft. per second. 430.3 × 0.2 = 86.06 cu. ft. per second.

The velocity head will be as before:

$P_v = (430)^2 \times 0.000018 = 3.33$ lbs., so that the drop will be increased by 3 lbs. for the above discharge, or 42 lbs. The weight per cubic foot at 42 lbs. pressure will be 0.1329 lbs.

86.06 cu. ft. × 0.1329 = 11.44 lbs. per second discharge at 42 lbs. pressure gauge.

The total heat at 75 lbs. pressure is.....1184.4 B.T.U.
The total heat at 42 lbs. pressure is.....1176 B.T.U.

Difference ..... 8.4 B.T.U.

The loss per pound discharge per second will be, due to radiation of main, 11.44 ÷ 16 = 0.71 B.T.U. per pound, with no condensation, as there are 8.4 B.T.U. per pound between 42 lbs. and 75 lbs. gauge.

The final condition of the steam will be 1184.4 — 0.71 = 11.83.7 B.T.U. per pound, which corresponds to 18° superheat at the end of the line.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

Opening Meeting of New York Chapter.

A gratifying attendance marked the opening meeting for the Fall season of the New York Chapter, which was held October 18, at Keen's Chop House. The members were the guests of the chapter for the evening and the business was conducted over tables that were spread for the collation that came later.

The report of the Board of Governors stated that a resolution had been passed urging that the annual meeting of the society be postponed from January to May, partly on the ground of inclement weather likely to prevail during the winter time, and partly because it was felt that a larger attendance could be procured at the later date. The resolution was forwarded to the council of the society and the chapter was advised later that the council did not feel it could arrange for a postponement of the society meeting holding that such a matter should be acted on at a business meeting of the society. After a discussion of the matter, President Driscoll appointed a committee, consisting of Frank K. Chew, Homer Addams and George W. Knight, to draft an amendment to the society's constitution providing for the annual meeting in May. The treasurer's report showed a balance in the chapter's treasury of $400.

It was announced that J. I. Lyle had been appointed chairman of the chapter's entertainment committee which will act at the society's annual meeting. The chapter's committee on tests will be appointed later.

A motion was carried endorsing the proposition of amending the society's constitution and by-laws so as to simplify the election of new members.

Rawson W. Vail of the American Blower Company's export department was then introduced, his subject being "Export Engineering." Mr. Vail said that quality and merit are not the only considerations, but that attention to the ways and customs of business houses in foreign countries was equally important. Americans, he said, would consider the heating equipment of most European buildings as decidedly inadequate. The opportunities for foreign business, however, lie in the newer countries, such as those of South America, Australia, South Africa and Japan and, probably later, China. In these countries the railroad offices and school buildings are most in need of improved equipment.

Foreign engineers are only called in when the project cannot easily be handled locally. American heating engineering firms are not conspicuous as yet in these fields. As a way to get in touch with some of this work, Mr. Vail suggested that American contractors and engineers advertise in the South American trade papers.

Mr. Vail referred to the equipment of the Bureau of Printing and Engraving in Peking, a $1,000,000 building which has American mechanical equipment throughout. He also told of a large planing mill installation in South America which had attracted wide attention on the part of people living in that section.

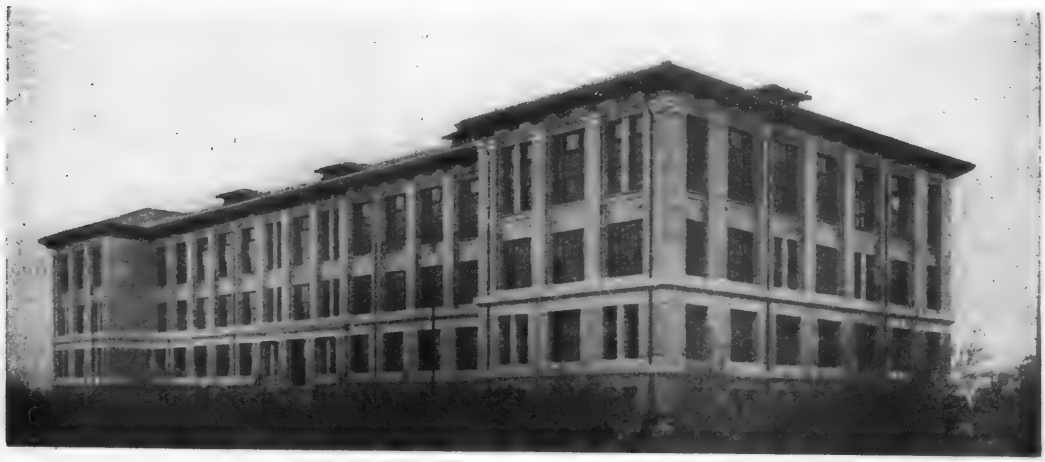
The main difference between export and domestic engineering, Mr. Vail said, was in connection with the system of units used, and it was necessary to become thoughly familiar with the metric system. Shippers must comply with the instructions given them in sending goods abroad, even to the color of the paper in which certain articles must be wrapped, as the natives get familiar with a certain color and insist on having it. Most of the engineering problems in these countries are now handled by European firms, but there are opportunities for American engineers, especially when it comes to the design of small power plants and all types of heating and ventilating work.

President Driscoll confirmed the speaker's last statement by relating a case that came to his attention in Chili where the design of a large power plant in connection with a copper refining project was given to an English firm, there being no applications from Americans for the work.

The next speaker was R. D. Hopkins, who spoke on "Engineering Work for the Chinese Government." Mr. Hopkins spent three years in Peking installing the mechanical equipment in the Bureau of Printing and Engraving building. Owing to the scarcity of skilled labor he was called upon to solve the unusual problems in connection with the installation work.

Mr. Hopkins said:

I suppose it would be appropriate for me to address you in Chinese, as the subject of



BUREAU OF ENGRAVING AND PRINTING, PEKING, CHINA.

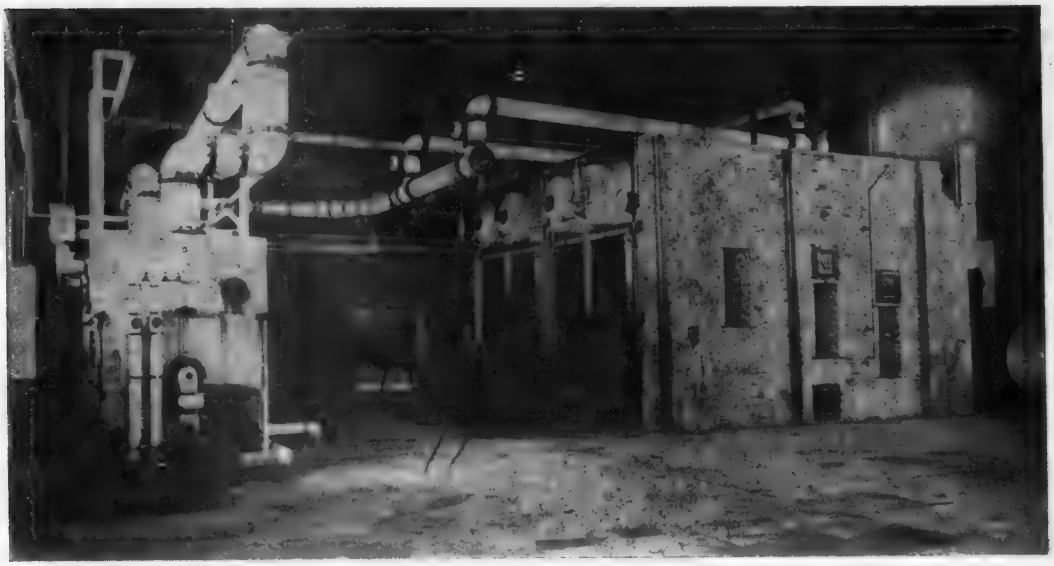
my talk will be engineering work in China. Therefore, I will say to you "How Ren, how bu how," which is the equivalent of "Good men, greetings to you." I highly appreciate this opportunity of being present as a guest of your chapter, and I will endeavor to interest you by telling of some of my experiences while installing the mechanical plant in the Chinese Government Bureau of Engraving and Printing at Peking, China, which comprises a group of buildings known as main building, power house and six officers' houses, pump house, etc.

The scope of the work included a complete power and lighting plant of two 250 H. P. B. & W. boilers; two 225 H. P. Harrisburg Corliss engines, each direct connected to a 150 K. W. Westinghouse direct-current generator; two 1,000 H. P. Cochrane feed water heaters and purifiers (the intention being to enlarge the boiler and engine capacity in the near future).

There are also two boiler feed pumps of the outside packed type; two electrically-driven volute sump pumps; two vacuum pumps for heating system; two steam air compressors for pneumatic temperature regulation; one 1,000 gal. Underwriter's fire pump.

There is a switchboard about 29 ft. long, having on it all of the latest switches,

VIEW TAKEN DURING CONSTRUCTION OF BUREAU OF ENGRAVING AND PRINTING.



BOILER ROOM, BUREAU OF ENGRAVING AND PRINTING.

circuit breakers, meters, etc., in the field at the time the plant was designed

An arc lighting system was installed for illuminating the grounds, and for this there is a 50 H. P. motor driving a 50 lighting alternating set complete with 45 outside arc lamps swung from a harp shaped hanger at the top of steel poles 35 ft. high.

The direct current lighting for the buildings was installed on the three wire system from generators to switchboard, and two wires from switchboard to panel boxes; the current used for lighting is 110 volts across 220, and 220 volts for the power service.

EXHAUST STEAM HEATING USED.

The system of heating employed was exhaust steam with mechanical extraction having the usual by-pass and reducing valves from high pressure steam. Direct radiators were installed in all of the principal rooms of the main building and officers' houses, and a portion of the power house, such as ink mill, color mill and the laundry. The direct radiators used were of the H. B. Smith Company's make. Vento radiators were employed for the drying rooms, tempering and heating stacks for the ventilating system.

ENGINE ROOM, BUREAU OF ENGRAVING AND PRINTING.

The overhead feed system of steam supply was employed for the direct radiators, with returns in trenches under the basement floor.

Fans and blowers were of the American Blower Company's manufacture; one No. 12 full housed double inlet blower and two No. 7 full-housed single and inlet exhausters, with three No. 2½ exhausters for special work. All of these fans were driven by motors.

We installed an underground system of steam and return pipes for the outlying buildings. These, together with the electric light and telephone wires, were run in water-proofed wood conduit made up on the premises by native labor. There is about 22,000 ft. of this material employed, ranging in size from 2 to 6 in. inside diameter.

The smoke breeching and smoke stack, the latter being 6 ft. in diameter and 150 ft. high, were built up in the field.

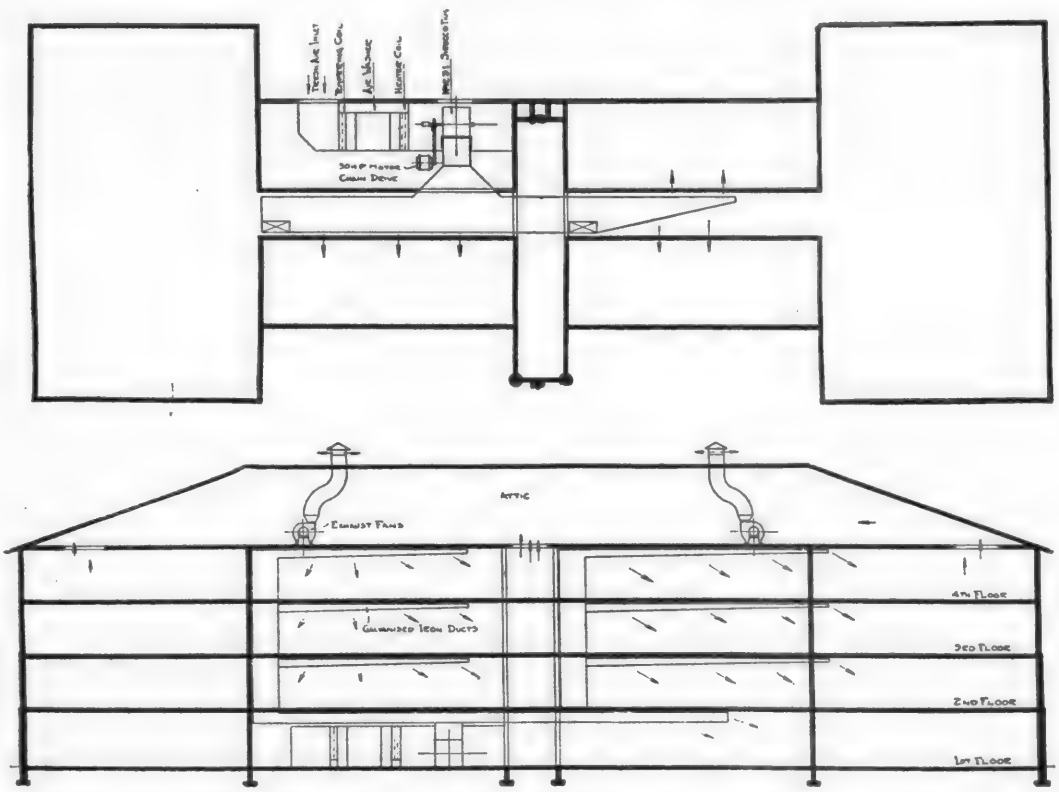
We also erected a 50,000 gal. anti-freezing water tower and tank over four artesian wells, 5 in. in diameter by 300 ft. deep. Over each well pipe we slipped a suction tube 3 ft. in diameter and 30 ft. long, into which the suction pipes from four electric triplex pumps were dropped, discharge from the pumps feeding the double tank. From this tank were run discharge pipes leading to the buildings for general supply and for fire service.

The method of erecting smoke stack and water tower would be considered quite unusual in this country. It was all done without the use of derricks, or engine hoist of any kind. A few sticks of timber and a couple of blocks and falls were the only thing used outside of the numerous Chinese coolies at the end of the rope.

A complete system of plumbing was installed of the same sort as is used here in New York, with hot and cold water supplies to all fixtures, which included bath tubs, water closets, urinals, showers, sinks, wash basins and wash troughs.

Separate sewers for house and rain water were installed which led to a sewer disposal plant and filtering beds.

A complete system of fire service piping was installed inside and outside of the buildings, with hose, racks and reels for the



PLAN AND ELEVATION, BUREAU OF ENGRAVING AND PRINTING, SHOWING HEATING AND VENTILATING SYSTEM.

buildings, and hydrants and hose carts for the outside.

Then we had inter-communicating telephone system with a 40 drop switchboard; a complete time-clock system, with master clock and twenty-four secondaries; a watchman's time detector system with twenty-four stations; a complete electric fire alarm system; temperature regulation for all principal rooms of the main building, power house and officers' houses, and an air washing and humidfying system; two Otis electric elevators with 10-ft. platforms; a complete system of ventilating ducts, conveying the air from the blower to the rooms and exhausting from the rooms to the exhaust fans with the usual registers, grills and dampers.

The labor employed was entirely Chinese, and the only assistance given me was an electrical engineer toward the latter part of my stay.

All pipe was worked on the job except the 10 and 12-in. which was cut to sketch from drawings made here in New York before my leaving. Some of the drawings were made here in New York a couple of months previous to my leaving, while the balance of them were completed in China. These drawings were used as working drawings from which we installed materials and I found it was necessary to employ a great deal of care in making these drawings so that the Chinese workmen could understand them.

EXPERIENCES WITH CHINESE LABOR.

One can well imagine how interesting it was to teach the Chinese to cut and thread pipe, put up a water-tube boiler, install the Corliss engine and generators, fans, plumbing fixtures, elevators, etc. The Chinese mechanics learn rapidly, and it was but a few months after I had schooled a picked few that we had a fairly good working gang, who were in turn taught by the first few so schooled.

Some of the best men were ordinary coolies taken from the fields, and this was accounted for by the fact that they knew nothing at all of mechanics and only did what they were taught to do. When a Chinese mechanic learns a thing a certain way it is very difficult to get him out of that way; but once he has learned a thing wrong it is equally hard to get him to do it right.

We had little trouble with leaky joints on the large pipe for the reason that they had so much labor at hand that they would employ a half dozen or more coolies on the end of a pair of chain tongs and rely upon the weight of numbers to make the joint tight. With small pipe, where there is no room for many coolies, we did experience a number of leaks.

The mechanic in charge is above exerting himself in the same order that the ordinary laborer would do.

The entire work was complete and operating before I left Peking.

The cost of labor varies somewhat with its class. A steam fitter is paid from $15 to $30 per month; a helper, $8 to $10 per month, while the coolie or laborer gets from $4.50 to $9 per month. These figures may seem very low, but as the labor is more deficient than efficient, the net result is nearly the same as we have in this country.

The cost of the entire installation was nearly $500,000, while the cost of labor amounted to about $40,000.

It required three years time to complete the work.

The buildings were designed by Messrs. Milburn & Heister Co., architects, of Washington, D. C., while the mechanical plant was laid out by Isaac Francis, of Philadelphia, Pa. The contract of installing the work was taken by Shewan Tomes & Co., of China and New York, by whom I was engaged to look after the actual work of installing. My duties covered everything that could possibly enter into a piece of work of this character, such as employing labor, listing and purchasing materials, getting materials through the Customs, having it carted to the building, storing it until it was needed, directing and superintending the actual putting in of almost every piece of pipe, every fitting and almost every detail of the work; making my own plans and blue prints, taking care of all correspondence, collecting and paying out the funds and keeping a set of books.

The cost and comforts of living need not worry anybody that might contemplate going to China. The cost is considerably less than here, while the comforts are considerably greater, owing to the many servants one can have for the price of a single servant here. The house accommodations are, in Peking and other coast cities, very comfortable indeed, although they are not quite up to our standards here. We built our own house and small office building near the site of the work.

The usual method used by the Chinese in heating their home is to set a lighted charcoal brazier in the room. These braziers are made of sheet iron, lined with clay.

M. J. Sage, M. W. Franklin and W. L. Fleisher were elected to membership in the chapter.

The principal speaker at the November meeting will be George W. Martin, of the New York Service Company, who will speak on "Operating Costs." The meeting place will be decided later.

Illinois Chapter Elects Officers.

New officers were elected at the October meeting of the Illinois Chapter, held October 11, at the Morrison Hotel, Chicago. The meeting also discussed the matter of licensing ventilating contractors. The election resulted as follows: President, E. L. Hogan; vice-president, F. W. Powers; secretary, W. L. Bronaugh; treasurer, August Kehm. Board of governors: Charles F. Newport, H. M. Hart and S. R. Lewis.

In opening the discussion on the licensing of ventilating contractors, President Newport stated that the suggestion had come from Commissioner of Health Robertson of Chicago. The point was made by some of the speakers that the licensing of contractors in other trades had improved conditions. On the other hand, it was held by many that a more stringent ordinance was preferable to licensing. It is expected that the matter will be further discussed at a later meeting.

R. H. Lindman and S. A. West were elected to membership in the chapter, and John F. Hale was reinstated to full membership, which he relinquished while located in the East.

The next meeting of the chapter was announced for November 8, at the Morrison Hotel.

New Officers Nominated.

The following have been nominated for office in the American Society of Heating and Ventilating Engineers by the society's nominating committee:

For president, Harry M. Hart, Chicago; for first vice-president, Frank T. Chapman, New York; for second vice-president, Arthur K. Ohmes, New York; for treasurer, Homer Addams, New York. For members of the council: D. D. Kimball, New York; Henry C. Meyer, Jr., New York; Dr. E. V. Hill, Chicago; Frank Irving Cooper, Boston; Walter S. Timmis, New York; Charles R. Bishop, North Tonawanda, N. Y.; Fred R. Still, Detroit; and M. W. Franklin, East Orange, N. J.

The Society's Educational Committee.

In accordance with the resolution passed at the recent semi-annual meeting of the society, regarding the formulation of a plan to provide a society course of instruction in heating and ventilating engineering, President D. D. Kimball has appointed a committee which will have general charge of the matter and the different members will also act as chairmen of sub-committees. The committee is authorized to provide a report on the advisability of taking up the proposition of a lecture or educational course, such report to be presented at the annual meeting of the society. The following are the members of the committee and the special features each will take up: Chairman, M. W. Franklin; J. I. Lyle, scope of educational work; W. S. Timmis, publicity; W. W. Macon, faculty; Frank K. Chew, ethics and welfare; Homer Addams, finance; J. J. Blackmore, secretary to the committee.

NATIONAL DISTRICT HEATING ASSOCIATION

Convention Proceedings for 1915.

The proceedings of the 1915 convention of the National District Heating Association have been received by the members. It is stated that this is the earliest date the proceedings have ever been mailed following the convention. In addition to the papers and discussions, the volume contains a general index covering the years 1909 to 1915, inclusive, prepared by Messrs. Hecht, Orr and Spake of Chicago. It is intended later to publish this index with the list of members that will be issued early in the year.

The Association's New Bulletin.

The first issue of the new quarterly Bulletin of the National District Heating Association has made its appearance, being dated October, 1915. The Bulletin is of standard magazine size, and its arrangement and contents reflect much credit on the association and on those directly in charge. In addition to the contributed articles there are departments on "Operating Kinks," "Our Committees," "Vaporized News," "Question Box," "Legal and Commission Department," and "With Our Advertisers."

Under the committee heading, it is stated that the station operating committee will take up, among other things, the subjects of (1) oil as a fuel; (2) bleeder type of turbo-generator, and (3) operating data relative to a certain heating plant on which accurate information will be obtained by the committee through tests made by one of the member companies.

The question box is conducted by J. C. Hobbs, of the Duquesne Light Co., Pittsburgh.

Applications for membership, it is stated, have been received as follows since the Chicago convention: H. M. Byllesby & Co., Chicago; Grinnell Electric Heating Co., Grinnell, Ia.; Lewis Jones, Jr., Overbrook, Pa.; J. C. Butler, Illinois Maintenance Co., Chicago; University of California Library, Berkeley, Cal.; H. R. Wetherell, Peoria, Ill.; M. B. Skinner & Co., Chicago; George C. Daniels, Peoria, Ill.; C. S. Barnes, Boston; and the Central Asbestos & Magnesia Co., Chicago.

Plain Talk on Engineering Societies.

Some of the shortcomings of engineering societies in general, and of the older ones in particular, came in for a frank discussion in an address delivered by Ernest McCullough recently before the Western Society of Engineers.

Mr. McCullough's address was entitled "The Engineering Society." He reviewed the causes leading up to the formation of the American Association of Engineers and blamed the older societies for not giving more attention to the young engineer.

The technical or engineering societies have not developed with the work of the engineer, he said, and went on to add, as reported by *Power*, that these societies are still lingering in the past and consider themselves as institutions organized solely for educational purposes. This is the way they are conducted, but the majority of the members know many societies exist rather as an evidence of the standing of the members than for their declared purposes. The modern technical journal is doing far more real educational work than any society, no matter how large or how important it may be. The pages of the weekly and monthly papers bring to us news from the front, fresh and in a way that the more formal papers of a society cannot. The society proceedings have become mere encyclopedias, which are consulted less frequently than are the pages of the journals maintained purely for profit.

ENGINEERING BODIES TOO OFTEN MUTUAL-ADMIRATION SOCIETIES.

There is a well-founded idea that engineering societies have for many years past been mutual-admiration societies of successful men and have been used for the furthering of insidious advertising by men qualified to take full advantage of the position their membership brings them. The papers are generally obtained only by hard work on the part of the publication committee in each society. The discussions are too frequently inadequate, and real criticism is seldom developed when the author of the paper is of commanding eminence. The young man learns something, but not much, from the papers and feels diffident about discussing them, as he fears his opinion would not be well received.

NEEDS OF THE YOUNG ENGINEER.

The young engineer does not want this. He wants scholarship, companionship and definite recognition. He is glad to attend a meeting where he knows refreshments will be served, not because of the refreshments, but because something to eat and drink signifies a lack of formality and perhaps an opportunity to mingle freely with older men who have made their mark. He wants to make acquaintances with men having like interests with himself and to feel that the society is more than an editorial body or an encyclopedia compilation of engineering facts—that it is composed of flesh and blood men who want to help him because of their knowledge of the trials and tribulations he is undergoing. He would rather know how to obtain a position and how to hold it than to hear how other men have done engineering work, for he reads the technical journals and gets a surfeit of such material.

The author spoke briefly of the formation from time to time of societies organized by young men and intended to help them meet their particular troubles. In these organizations the employment question is uppermost, and while they may perhaps thrive while times are dull. they all fail when members have positions and forget to continue paying dues. This led up to a discussion of the object of the American Association of Engineers which was originated to raise the standard of ethics of the engineering profession and to promote the economic and social welfare of engineers. These objects are to be obtained by affording means for an interchange of information, by maintaining a service clearing-house, by affording patent and legal advice, by supervision of legislation and by proper publicity.

OLDER SOCIETIES NOT ATTENDING TO BUSINESS.

In analyzing the objects cited and the methods by which they were to be obtained and how they conflicted with the objects of the older associations, the author was of the opinion that the older societies were not attending to business. The work outlined should be attended to by the veteran. "Old men for council, young men for action," should be the motto of the older societies. If this were the motto and lived up to properly, the young men should obtain all the objects sought and the societies would grow

faster than they are now growing. The members should receive the worth of their money—the older men in the feeling of satisfaction following every worthy action, the younger men in the experience of material benefit.

Discussing the methods outlined, the older societies can honestly say only the first has been attempted by engineers—that of affording means for an interchange of information. That a service clearing-house has not been properly attempted is a reproach. The engineer is a wanderer from job to job. When capital is active he is hard to find. When dull times come and capital rests, the streets are full of technically trained men out of work. They wander from office to office, many of them starving and too proud to admit it, many never getting a substantial footing. Their work is concerned with new enterprises and with the day laborer they share the ups and downs of fortune. There is a place for all, and it is the duty of the older engineers to take care of their brothers. Every day the Western Society and the other large societies delay in organizing a service whereby members out of employment can be placed in positions is an inexcusable reproach. The organization is already formed. It requires only the spirit.

SOCIETIES SHOULD ACT AS EMPLOYMENT AGENCIES

Any society should not limit its efforts in this direction to members, but should give members the preference, all things being equal. All members needing men should file their wants with the secretary of the society and not attempt in any other way to secure men until the secretary says there are none available. All members might be classified by specialty and lists printed, so that those wishing to get in touch with men in any special line of work may have such a list given to them by the society and then make a choice.

The affording of patent and legal advice needs to be approached with care. The society should have an attorney who can help members that have trouble in collecting pay. That is, members who fall into the hands of unscrupulous employers.

LEGISLATION FOR THE TECHNICAL MAN.

The fourth method is concerned with legislation for the technical man. The architects are working hard to obtain legislation to make architecture a closed profession, beginning with the passage of the license law for architects in Illinois in 1897. A number of the States have similar laws, the greater number of which were passed during the present year. Engineers were opposed to legislation to license engineers, but conditions in the State of Illinois became so intolerable on account of the monopoly given to architects that the Western Society this year obtained the passage of a law to license structural engineers. This one thing has done more to help the society than any other single thing since it was organized. The next piece of legislation to be attended to is one fixing the status of sanitary engineers, or the plumbers will get ahead and obtain control of the design and construction of sanitary work. It is not the intention to make a closed profession of sanitary engineering, but to prevent injustice to such engineers because of legislation that may be secured in other lines of work, it will be necessary to have examinations and licenses for them.

WOULD REGISTER TECHNICAL ENGINEERS.

A better way would be to secure a law requiring the registration of technical engineers with an examining board qualified to examine men in different specialties, so that the word "engineer" will possess a dignity comparable with the titles of the other learned professions. Not only must the modern engineering society see that legislation is secured to protect and elevate the engineering profession, but it must also carefully look after proposed legislation to the end that no laws which work harm to the people of the State will get on the statute book. That is, as a citizen, the engineer must protect those that lack knowledge of technical affairs and are left at the mercy of special interests.

As to what is proper publicity depends upon changing ideas and advances in civilization. The advertising methods of the live, wide-awake business man may be considered coarse and unbecoming for the professional man. Is this idea a survival of a generation past? Is it, as many young men claim, a fetish worshiped by professional men for the purpose of helping older men maintain their preëminence and hold the young man back? The question must be answered individually just now. Throughout his life the technically educated man, the engineer, is at times a professional man, a technical employee and a business man. He must do some publicity work, and society should not be hidebound in what is to be considered proper means of publicity to be employed by individual members. It should be enough for the societies that the members remain decent and bring no discredit on the work of the technical men.

The societies heretofore have concerned

themselves with the publicity work of individuals. What is now a crying need is publicity work of the proper sort by the societies for the benefit of the membership and incidentally of the technically educated men not members of any society. Through proper publicity work all technical men not members will want to become members. Incidentally, the work of technical men will be so placed before the public that there will be an increase of good material in the ranks. Proper publicity should have the effect of sifting out desirable men from those not so desirable. It is because of improper publicity work that there are so many complaints today of too many unfit men enrolled as engineers. These men, no matter how unsuited they may be to the work of the engineer, have a place somewhere in the world where they can fit in, and it should be part of the duty of the engineering societies of the future to find the holes in which these misshapen pegs may fit.

Formula and Rules for Warm Air Heating.

An important publication has recently been issued by the National Warm Air Heating and Ventilating Association containing a carefully-compiled formula and rules for the installation of warm air heating apparatus.

The full rule for determining heat requirements is as follows:

In figuring the heat requirements of any given room in square inches pipe area, the following rules, which are easily understood and simple to use and work out, are recommended as rules which have given general satisfaction.

1. Find the total square feet of glass surface in windows and outside doors, taking the full opening measurements and counting outside doors as all glass; then measure the surface in exposed outside wall, from which subtract the glass surface; next reduce the wall surface to equivalent glass surface by dividing the net amount by:

10 if wall is 8 to 10 in. thick,
15 if wall is 12 to 26 in. thick,
20 if wall is 26 to 38 in. thick.

To this result, add the glass exposure; then as 1 sq. ft. of glass surface cools 75 cu. ft. of air per hour, multiply the total glass equivalent by 75, which will give the total cubic feet of air to be heated to offset the loss from glass and wall exposure. This total added to the cubical contents of space to be heated gives the amount of air to be heated.

2. For a temperature of 70° F. in zero weather, multiply the amount of air to be heated by 0.01222 [see note below (*)], and the result will be the heat requirements in square inches pipe area. For each degree below zero for which the heating is to be required, add 1% to the heat requirements.

This rule gives the total heat requirements of the room in square inches pipe area; and judgment must be used in increasing the number of square inches pipe area in the rooms on the cold side, exposed to the north and west, and reducing the number of square inches pipe area on the warm side; also making allowance for poorly constructed buildings, loose-fitting windows, etc.

Add the square inches pipe area of all the rooms and choose heater of such capacity, as the result indicates.

SHOWING RULE IN USE.

Problem—

What are the heat requirements in square inches pipe area of a room $12\times18\times9$ ft., with four windows, $3\times5\frac{1}{2}$ ft. each, with two outside walls 10 in. thick—heating required for 10° below zero?

Answer—

Square feet of glass surface, $3\times5\frac{1}{2}\times4=66$.

Square feet of outside wall surface, $12+18=30\times9=270$.

Net wall surface exposed, $270-66=204$.

Equivalent glass surface in wall exposure, $204\div10=20$.

Amount of air cooled by glass and wall surface, $20+66=86\times75=6,450$.

Cubical contents of room $12\times18\times9$ ft. $=1,944$.

Total cubic feet of air to be heated, $6,450+1,944=8,394$.

Heat requirements in square inches pipe area for zero weather, $8,394\times0.01222=102$.

Heat requirements for 10° below zero, $102+8=110$ sq. in. pipe area.

**Note*—The coefficient or factor 0.01222+, which we advise using, as per rule, is derived from the following formula:

$$\text{H. S.} = \frac{H\times55\times144}{60\times3\times3,600} = 0.01222+.$$

In the above formula—

H. S. = area of heat stack in square inches.
H. = heat loss from room in B.T.U. per hour.
55 = number of degrees through which 1 cu. ft. of air can be heated by 1 B.T.U.
144 = number of square inches in 1 sq. ft.
60 = average difference in temperature between air leaving register and room temperature.

3 = average velocity in feet per second of air in heat stack to first floor rooms.
3,600 = number of seconds in 1 hour.

A SHORT RULE FOR SMALL ROOMS.

This is accompanied by a short rule for use in cases where installers do not wish to go through the detail of figuring the complete rule. This short rule is in the form of a table of warm air pipe diameters for residence heating and is intended to apply to rooms of less than 1,300 cu. ft. area, and using 8-in. pipe.

Contents, cu. ft.	One outside exposure.	Two outside exposures.
1,300 to 1,800	One 9″ pipe	One 10″ pipe
1,900 to 2,400	One 10″ pipe	One 11″ pipe
2,500 to 3,000	One 11″ pipe	One 12″ pipe
3,100 to 3,600	One 12″ pipe	One 14″ pipe
3,700 to 4,200	One 14″ pipe	Two 11″ pipes
4,300 to 4,800	Two 11″ pipes	Two 12″ pipes

For rooms with unusual exposures, figure one size larger pipe than called for in the above tables; for second and third floor rooms, one size smaller.

The booklet also contains rules for pipes; pipe and register sizes, including equivalent areas of round pipes, flat register pipes, risers and registers; table of average pipe sizes; wall pipe and fittings; directions and rules for cold air supply; fresh air room; chimney flues.

Fresh air rooms are strongly recommended as they provide, it is stated, for a far better control of wind currents. The recommendation is that they should be three times as large as the air supply and well insulated to prevent cooling from the floors above.

The following table is included on chimney flues:

Diameter, round chimney flue, inches.	Size, square chimney flue, inches.	Size, rectangular chimney flue, inches.	Height of chimney flue above grate, feet.
8	7½ × 7½	6 × 10	30
9	8½ × 8½	8 × 10	32
10	9½ × 9½	8 × 12	34
11	10½ × 10½	10 × 12	36
12	11½ × 11½	10 × 14	38
13	12½ × 12½	12 × 14	40
14	13½ × 13½	12 × 16	40
15	14½ × 14½	14 × 16	40
16	15½ × 15½	14 × 18	40
17	16½ × 16½	14 × 20	40
18	17½ × 17½	16 × 20	40
19	18½ × 18½	16 × 22	40
20	19½ × 19½	18 × 22	40

Effect of Wall Paper on Room Ventilation.

A writer in the Journal of Gas Lighting describes experiments made with a view to seeing whether the ventilation of rooms could be improved in any simple way. Originally, both experimental rooms had a light wall paper which had become somewhat dirty through lapse of time. Later the paper was stripped from one of the rooms and the walls whitewashed, and subsequently the other room was treated in the same way. The whitewashed walls naturally caused a considerable increase in the illumination on the table or desk in the room. The result of observations of the temperature, humidity, proportion of carbonic acid and ventilation of the papered and whitewashed rooms showed that the ventilation was 17% greater in the whitewashed room. On this account whitewash seems preferable, and the author sees no hygienic advantage in wall papering. The tabulated results show that the proportion of carbonic acid in the air of the room at the end of each test was appreciably lower with whitewashed than with papered walls.

Other parallel experiments were made to ascertain the effect of different methods of ventilation. One pair of experiments shows the effect of opening wide and closing the door once every half hour during a seven-hour period. The ventilation was improved about 10% by this periodical opening of the door. Other sets of tests compared the effect of taking the air supply to the gas stove from the corridor with taking it from the room itself. The supply of air to the gas stove from the room itself improved the ventilation by about 20%.

In other tests the effect of opening the window flap while the gas stove took its air supply from the room itself was tried, with the result that it was found that the ventilation was thus increased by 74%. Finally, a series of tests was made in which the vent pipe in the ceiling was opened. This was most effective, the ventilation being increased two and one-half to two and three-quarter times, and in one case even five times. Obviously, this increased ventilation must affect the humidity of, and proportion of carbonic acid in, the room. The author thinks, however, that these tests with the open vent pipe have not much practical significance, as there is usually no provision for ceiling ventilation in living rooms.

The autumn meeting of the (British) Institution of Heating and Ventilating Engineers was held in London, October 12, when papers were read by Walter Jones on "Heat Transmission and Heat Emission," and by Samuel Naylor on "A Comparison Between Forced Firing and Slow Combustion." A report was also presented on the research work at the University College which has been conducted by A. H. Barker.

Saving Fuel in Heating a House

WITH RESULTS OF A TEST IN A CONNECTICUT RESIDENCE.

Exhaustive information on the various fuels used for heating residences, the factors governing the consumption of fuel and convenience of operation, together with general suggestions on the firing of different fuels, is contained in the report of a government investigation carried out by L. P. Breckenridge and S. B. Flagg. It is published as Technical Paper 97 of the Bureau of Mines, Department of the Interior.

It is stated at the outset that of the 570,048,125 tons of coal mined in one year in the United States, probably 10% to 15% went to purchasers who used it largely for heating dwellings. Facts are then given regarding wood, anthracite coal, bituminous coal, sub-bituminous coal, lignite, peat, coke, fuel oil, and gas; also the use of electricity for heating. The advantages and disadvantages of the various fuels are given as follows:

Under "Methods of Heating Residences," all of the modern systems are briefly described, with hints on the various factors affecting their design and governing the consumption of fuel. These hints cover such items as climate, size and type of dwelling, location of dwelling, life of heating apparatus and convenience of operation. Under "Size of Boiler and Furnace," it is stated that until the last five years both makers and buyers of house heating boilers and furnaces gave little thought to the fuel to be burned. In fact, the ratings now published for much of the heating equipment, it is stated, are based on the use of one of the large sizes of anthracite coal. Emphasis is laid on the depth of the fire pot which, where the full rated load is to be carried without attention to the fire for a minimum period of eight hours, should have a fuel bed at least 12 in. deep.

ONE SEASON'S OPERATION OF A RESIDENCE HEATING PLANT.

The publication concludes with interesting figures on the fuel consumed in heating the residence of Prof. E. H. Lockwood,

Fuel.	Advantages.	Disadvantages.
Wood.....	(a) Cleanliness, (b) cheerful fire, (c) quick increase of heat, (d) cheap in some localities.	(a) Low fuel value, (b) large storage space necessary, (c) labor in preparation, (d) scarcity, (e) does not hold fire long, (f) unsteady heat.
Anthracite.....	(a) Cleanliness, (b) easy control of fire, (c) easier to realize heat in coal than is the case with other coals, (d) steady heat.	(a) High price, (b) difficulty of obtaining, (c) slower response to change of drafts.
Bituminous coal.	(a) Low price, (b) availability, (c) high heat value (in the best grades), (d) low percentage of inert matter (in the best grades).	(a) Dirty, (b) smoke produced, (c) more attention to fire and furnace necessary than with anthracite.
Sub - bituminous coal and lignite.	(a) Relatively low price, (b) availability (in some regions), (c) responds quickly to opening of drafts.	(a) Slakes and deteriorates on exposure to air, (b) takes fire spontaneously in piles, (c) heat value generally low, (d) heat in fuel difficult to realize, (e) fires do not keep well, (f) gases generated over fire pot sometimes burn in smoke pipe, causing excessive heating.
Peat.....	(a) In general, the same as for wood	(a) Low heat value, (b) bulkiness.
Coke.....	(a) Cleanliness, (b) responds quickly to opening of drafts, (c) fairly high heat value.	(a) Bulkiness, (b) liability of fire going out if not properly handled, (c) fire requires rather frequent attention unless fire pot is deep.
Oil.....	(a) High heat value, (b) immediate increase of heat, (c) cleanliness, (d) small storage space necessary.	(a) High price, (b) difficulty of safe storage.
Gas.....	(a) Ease of control, (b) cleanliness, (c) convenience, (d) immediate increase of heat.	(a) High price in many places.
Electricity.....	(a) Every advantage.....	(a) High price.

of the Sheffield Scientific School, Yale University, for the heating season of 1912-1913.

This residence is located at 52 Division Street, New Haven, Conn., and has a north and east exposure sheltered by trees, while on the west it is protected by a house 20 ft. distant. It is of frame construction, with clapboard on first floor, shingle on second floor and slate roof. There are two stories, also attic and cellar, containing in all ten rooms. The windows are of single glass, in good condition, with storm windows on the north side.

The dimensions of the rooms and the radiation installed are as follows:

Name of dealer— ..... Coal Co., New Haven, Conn.

In charge of furnace—Owner, aided by family.

Firing schedule in cold weather—Coal fired at 7:30 A. M., 8:30 A. M., 1 P. M., 6:30 P. M., and 10 P. M.

Automatic appliances—Clock to open pipe damper at 5:30 A. M. Used every night.

The furnace was started October 2, 1912, and the furnace fire ended May 22, 1913, although it was not going continuously after May 1. The furnace was, therefore, in operation 219 days, or 31.3 weeks, or 7.3 months.

DIMENSION OF ROOMS AND RADIATION INSTALLED.

Floor.	Room.	Floor space, feet.	Volume, cubic feet.	Amount of hot-water radiation installed, feet.
First	Parlor	13×14	1,300	52
	Dining	14×16	2,030	61
	Living	16×20	2,800	150
First and second	Hall	8×10	1,200	65
Second	Bedroom	12×14	1,320	31
	"	13×14	1,450	35
	"	11×11	980	22
	"	9×11	700	26
	Bathroom	6× 8	400	13
Attic	Bedroom	10×12	850	26

The heating system is hot water, with direct radiation; the name of the heater is not given. It has, however, a fire pot 20 in. in diameter, and 2.2 sq. ft. of grate area. The radiators are of cast iron, some 19 in. high and some 33 in. high.

The actual total amount of hot water radiation is 481 sq. ft. Other details are:

(a) Exposed double-glass surface—130 sq. ft.

(b) Exposed single-glass surface—286 sq. ft.

(c) Exposed wall (plaster and clapboard)—1,750 sq. ft.

(d) Total volume of space heated—13,000 cu. ft.

Supplementary heating system—2 fireplaces, 1 in dining-room, 1 in living-room.

Wood burned in fireplaces—1 cord a year.

Kind of wood—Oak and maple, 2-ft. lengths.

Use of fireplaces—Dining-room fireplace used nearly every morning in cold weather for about 1 hour; other fireplace used less, more for cheerfulness than for heating.

FUEL AND METHOD OF FIRING.

Kind of fuel used—Yard pea (intermediate in size between washed pea and No. 1 buckwheat).

Cost of coal, delivered in bins—$4.25 per short ton (2,000 lbs.).

The total amount of coal burned during the season was 18,780 lbs., or 9.4 net tons, making the average weight of coal burned per day 86 lbs. The greatest weight of coal burned per day (for two days only, January 13 and February 6) was 160 lbs., while the smallest amount was 20 lbs. The maximum for any one week (February 7-13) was 960 lbs., and the minimum (April 23-30), 160 lbs. The average weight of coal burned per square foot of grate per hour on the coldest day was 3 lbs. The cost of coal for the furnace for the season was $40.00, the cost of wood for the fireplaces for the season, $8, making a total of $48.

TEMPERATURES AND CALCULATED RESULTS.

Average daily temperature inside for whole season, assumed.....69° F.

Average daily temperature inside during coldest week assumed.....66° F.

Average daily temperature outside for 219 days, October 2, 1912, to May 22, 1913, from records of New Haven Weather Bureau .....41.5° F.

Same for coldest week of Winter, February 7-13, 1913 .....20.7° F.

Constants used for obtaining heat loss from house:

(a) Double glass per square foot per hour .....0.46 B.T.U.

(b) Single glass, per square foot per hour .....1.03 B.T.U.

(c) Walls (plaster and clapboard)...0.44 B.T.U.

Calorific value of coal was not determined, but from analysis of washed pea sold in New Haven, it was estimated at .....12,500 B.T.U.

Heat loss from house, figured from items 23, 50, 51, 52, 53, 54, average from October 2, 1912, to May 22, 1913, per hour .....31,000 B.T.U.
Same, average during coldest week from February 7-13, 1913, per hour.....50,800 B.T.U.
Heat theoretically available in fuel, figured from items 41, 44, 55 (assuming 1 cord of wood equal to ½ ton of coal):
(a) Average from October 2, to May 22, per hour.....47,500 B.T.U.
(b) Average during coldest week, February 7-13, 1913, per hour.75,800 B.T.U.
Average furnace efficiency, figured from items 56, 57, 58a 58b:
(a) For 219 days, October 2, 1912, to May 22, 1913 .....65%
(b) For coldest week, February 7-13, 1913 .....67%

MISCELLANEOUS REMARKS.

Number of years same furnace has been used with this fuel by present owner—Five years.
Experience of owner—All rooms can be kept comfortable (70° F.) in coldest weather, except 2 rooms (items 8 and 12). These rooms have insufficient radiation and can not be heated above about 65° F. in coldest weather.
Use of rooms—All rooms in the house have been used continuously and heated during entire winter.
Capacity of heater—Has been ample to supply hot water at all times.

The coal was weighed by means of a 25-lb. spring balance, which was hung from a bracket on the side of the coal bin. Coal was shoveled into an ordinary scuttle holding 20 lbs. net, and after weighing was dumped into a supply box holding 40 lbs.

The report is characterized as "showing not only a low cost of heating, but also an economical use of fuel and illustrates what savings may be effected when the problem is given proper consideration. Yard pea could be used because the heater was large enough to burn the coal, even in the coldest weather, at a low rate of combustion per square foot of grate area. Systematic and regular handling of the fire doubtless had considerable to do with the results obtained. The cost of heating is probably $50 to $100 less than what is expended by a large number of householders who live in the same locality and have about the same heating requirements, but use more expensive fuel and give their heating equipment less attention."

A Case of "Natural" Heating.

Nature is a kind mother, full of wonderful inventions, but to hear that she can heat a whole hospital with hot water in an installation of pipes without the aid of fire of any kind seems almost too marvelous to be true. Yet at Acqui, in Italy, the large modern building which has hitherto been used for the Communal Schools, and has now been turned into a hospital where some hundreds of wounded soldiers are housed and tended by French nursing sisters, has a system of hot water pipes entirely supplied from the celebrated boiling spring in the centre of the little town, a natural source which yields 118 gal. of hot water per minute at a temperature of 165°. Further, all the water used in the hospital for washing and cleaning purposes comes straight from that wonderful well, so there is no need of fires or furnace, and no expense in fuel—a welcome economy in war time, when coal and coke have risen in price.—*Domestic Engineering (London).*

CORRESPONDENCE

Determining Butt and Lap-Welded Pipe.

EDITOR HEATING AND VENTILATING MAGAZINE:

Will you kindly inform me as to the best practical way of determining whether pipe is lap-welded or butt-welded? I should like to know if it is possible to do this without resorting to chemical means, and also, what is the method of conducting the chemical analysis? E. A. L.

Westmount, October, 1915.

REPLY BY F. N. SPELLER, METALLURGICAL ENGINEER FOR THE NATIONAL TUBE COMPANY.

The following method of determining whether pipe is lap-welded or butt-welded is the most satisfactory, as it requires only one chemical:

First cut a transverse section from the pipe in question, and smooth one end of it on an emery wheel or with a file. The end should then be polished with fine emery paper until all scratches, which might be

CONSTRUCTION OF BUTT AND LAP-WELDED PIPE.

confused with the weld, are removed. This polished annular surface is now dipped into a shallow vessel containing a 10 to 15% solution of sulphuric acid, somewhat warmed. It would be well to note that care must be exercised in mixing concentrated sulphuric acid and water, always pouring the acid into the water while stirring constantly. Considerable heat is generated, which may crack the container if made of heavy glass or porcelain. A glass laboratory beaker is most satisfactory.

The acid will gradually etch the polished surface, giving it a uniform grayish color, except at the weld, where a fine black line

will gradually appear. Usually only a few minutes are required for this operation, but the time will vary greatly with the temperature and strength of the solution.

The two sketches shown below indicate the general appearance of the two welds:

The line in the butt-weld is usually straight, while in lap-weld it is curved.

A good non-chemical method of differentiating pipe welds consists in driving a round wedge or drift into one end of the pipe until it fails. Lap-weld pipe will not always open at the weld under this treatment, but in nearly every case butt-weld will open in such a way as to show very definitely the nature and position of the weld.

If the weld is visible on the outside of the pipe, it may be forced open by crushing down in a vise or hammer, being careful to place the weld on the side so that it will be under the greatest strain.

Neither of the last two methods are as satisfactory as the first one, but are usually sufficient if the investigator has had a little experience.

There is no "chemical analysis" method of determining the nature of the weld.

Mechanical Features of the Panama-Pacific International Exposition.

By Guy L. Bayley.

(From a paper presented at the San Francisco meeting of the American Society of Mechanical Engineers.)

With three large electric companies in the field, each capable of supplying needs of the Panama-Pacific International Exposition, at San Francisco, the necessity for building a power plant was not considered. The Pacific Gas and Electric Company, which furnishes electric energy to the exposition, has a substation on the grounds, and the interesting feature of a power plant in operation is supplied by the Sierra and San Francisco Power Company, whose 18,000-kw. plant is located within the grounds, about 500 ft. east of the Palace of Machinery. This plant is operated in conjunction with a hydroelectric system for supplying energy to the United Railroads, and is an excellent example of a standby station with steam turbines and oil-fired boilers. Under an arrangement with the Pacific Gas and Electric Company, this steam plant is kept in operation continuously, so that in the event of an interruption in the regular source of supply it will carry the load of the exposition.

With the exception of the spaces occupied as offices, no heating was provided for the main exhibit buildings other than the Service Building, Administration Building, Press Building, Festival Hall, Palace of Horticulture and the Auditorium at the Civic Center.

GAS-FIRED AIR HEATERS USED IN FESTIVAL HALL.

The heating of Festival Hall is a departure from standard practice in that a system was installed using gas-fired hot-air heaters with forced circulation. While gas at 75 cents per 1,000 cu. ft. is an expensive fuel, its use for the short period of the exposition was justified by the saving in the initial cost of the plant as compared with a steam plant. The heaters and supply fans are located in two rooms, one on each side of the main auditorium. Each fan room contains two steel plate fans, each having a capacity of 1,500 cu. ft. per min., and four hot-air furnaces, each capable of burning 440 cu. ft. of gas per hour. The arrangement is such that one fan serves two heaters and delivers air through registers located in the columns around the main entrance, while the other fan discharges into a plenum chamber beneath the raised side seats, openings being provided in the risers for the discharge of air into the auditorium. Air is removed from the auditorium by two multi-blade exhaust fans installed beneath and on each side of the stage, and having a combined capacity of 5,200 cu. ft. per min. All fans are belt-driven by direct current motors equipped with armature control.

In the California building, the administration quarters are heated by 8,700 sq. ft. of direct radiation with vacuum returns. Steam for the heating system and for the hot-water supply and kitchen equipment is supplied by two oil-fired, cast-iron boilers operated at a pressure of 5 lbs. Ventilation for the ball-room is secured by two 60-in. disc fans located in the attic space.

To provide the necessary heat in the dome portion of the Palace of Horticulture, which is essentially a large conservatory, a hot-water system with forced circulation was adopted. The hot water is supplied from a model boiler plant located about 90 ft. south of the main building, in which are installed two oil-fired cast-iron boilers equipped with vertical, rotary burners. Owing to the architectural requirements of the neighborhood, it was undesirable to use a tall stack, and smokeless combustion has been secured with a stack which is only 30 ft. high from the burners and terminates in the staff basket. Forced hot-water circulation is produced by two centrifugal pumps designed to operate against a head of 40 ft., each direct-connected to a 7½-h.p. induction motor. Re-

cording thermometers and a flow meter enable accurate records to be kept of the amount of heat delivered by the plant.

The heating required for the section beneath the dome was calculated on the basis of 3,725,000 cu. ft. of space, 54,650 sq. ft. of glass surface, and 15,470 sq. ft. of wall surface. It was assumed that there would be one complete change of air every three hours and a loss of six B.T.U. per hour per square foot of wall surface and 17 B.T.U. per hour per square foot of glass surface, making—a total of 1,376,800 B.T.U. required per hour to maintain a temperature of 50°F., with an outside temperature of 35°. The four rooms adjoining the dome section were figured for temperatures from 60° to 80°F., which brought the total requirements of the building to 3,582,000 B.T.U. per hour, requiring the circulation of 190,000 lbs. of water per hour, with an initial temperature of 250° and a loss of 20°. Radiators of the cast-iron type were used instead of the customary pipe coils, with satisfactory results. Thermostatic control was installed in several of the rooms for regulating the temperature of ponds. The plan of using forced circulation and high temperatures made possible a material reduction in the size of the mains and the quantity of radiation required.

Minor heating installations were provided in various buildings, such as the Service Building, which is heated by direct steam radiation of the single-pipe system, while the Press Building is heated by the Rector system, which burns gas in connection with cast-iron radiator elements, the products of combustion being removed by means of a fan located in the basement. The offices in the exposition palaces and most of the buildings erected by participants are heated by gas radiators or gas stoves of the radiant type, flues being provided to carry away the products of combustion.

Owing to the fact that the Auditorium in the Civic Center is a permanent, four-story-fire-proof building, a modern heating and ventilating system was installed. In order that the main hall might be used for dances and other functions, a system of heating and ventilation was adopted which left the floor free of obstructions. Fresh air is forced through the openings in the balcony risers and grilles along the face of the balcony. The grilles are supplied with separate ducts, whereas the openings in the risers receive their supply from a plenum space beneath the balcony seats. Exhaust fans are provided to remove the air through smaller grille plates above the balcony and just below the base of the auditorium dome.

For supplying fresh air, two fans are installed in the basement, each having a capacity of 145,000 cu. ft. per minute. Two main exhaust fans, each capable of handling 70,000 cu. ft. per minute are installed in the attic, and two exhaust fans of 75,000 cu. ft. per minute capacity in the basement. Additional supply and exhaust fans are provided for the banquet rooms, toilets and kitchens, these fans having a total rating of 39,000 cu. ft. per minute. The fans, of which there are 18, and the vacuum pumps, are belt-driven by motors aggregating some 250 h.p. Heating coils are used in connection with the various fresh-air supply fans, and provision has been left for air washers, should they ever be found necessary. Direct radiation is used for the upper corridors, convention halls and offices.

The Coming Use of Bituminous Coal.

The United States today furnishes about 40% of the coal mined in the world. Our hard coal will last us, we are told, about 100 years, provided our present rate of consumption is continued. The supply of soft coal, the experts agree, will last at least a thousand years at the present rate.

Anthracite coal becomes more valuable if left in the ground. Each year the price always goes up and the more you leave the more you will sell by and by. On the other hand, bituminous coal is being mined more freely, so it is evident we must burn bituminous coal.

Each inhabitant had generated for him about four times as much power in 1910 as in 1870; in other words, we are becoming an industrial nation and the reason that we have the smoke problem with us is because of the fact that we are continually using more and more coal.

A letter from the Chicago Smoke Department the other day said. "We have not accomplished all we thought we could ten years ago, but still we have done a good deal. While we are giving attention to one kind of thing, we find we are getting into trouble with all this residence work. I think you will be glad to know that two or three of the very largest companies that furnish heating appliances for homes have spent in the last few years a great many thousands of dollars, and have had two or three experts employed all the time trying to produce heating boilers that would operate at low rates of combustion and not make smoke, and that their efforts have been successful."

Last month I saw a boiler suitable for heating residences, containing 1,500 sq. ft. of radiation, into which was fired at one

time 350 pounds of Illinois coal. Smoke of about No. 3 grade issued from the stack for only three minutes, and then for three hours and a quarter no smoke at all. In other words, there are furnaces today that will operate with attention from a janitor, perhaps once in four hours, that will burn very poor grades of coal and not smoke. I think that the manufacturers themselves realize that the next demand will be for smokeless boilers for small heating jobs. It may be from 20 to 150 horsepower on the horsepower basis, or heating buildings containing from 1,000 to 15,000 sq. ft. of radiation.—*L. P. Brechenridge, before the Cleveland Engineering Society.*

University Laboratories May Assist Business.

An effort to get the universities of the country to handle specific problems for the industries by experiments or otherwise, is being made by the Chamber of Commerce of the United States. At a recent meeting of the directors it was voted to refer the matter of co-operation between the universities and representative business establishments to the chamber's committee on education or to a special committee and it was further ordered that the subject be taken up with the educational institutions for the purpose of ascertaining the extent to which these institutions may be interested.

At present large industries such as glass making, food, steel and drug manufacturing are connected by very slight threads with the great universities or with the government, except as the government exercises police supervision over the products of the business industries.

In addition to the plan for having the universities make particular investigations, it is suggested that the universities might be induced to organize a course of study, training the students along particular lines that would be of direct benefit to the industries. The understanding would be, in this case, that these manufacturers would be willing eventually to take the most desirable of these students into their plants for the working out of the future scientific development and the problems of manufacture.

Cleveland Contractors' Stand Against Free Engineering.

The full text of the resolution passed by the Cleveland Association of Master Steam and Hot Water Fitters regarding the preparations of plans for heating systems, passed October 1, states that:

Whereas, The members of this association are frequently called upon to estimate the cost of heating systems for buildings, for which no heating plans have been drawn, such practice entailing an undue expense upon its members, inasmuch as several plans are thus prepared for each installation where but one is necessary, thus causing, in the aggregate, a considerable economic loss; and

"Whereas, In many cases where the radiator and pipe sizes are shown, the heating contractor is required to guarantee the amount of radiation to be adequate to meet certain temperature requirements;

"Therefore, Be it resolved, that the members of this association refrain from bidding upon the installation of mechanical heating and ventilating systems, and of all direct radiation systems where more than ten radiators are to be installed, unless a complete plan and specification for same is furnished; and be it

"Resolved, that in the case of the installation of such heating systems, the architect or engineer having specified the amount, kind and location of radiation, he shall assume the responsibility for its capacity; and be it further

"Resolved, that when members of this association are required to prepare plans and specifications of any heating or ventilating system, they shall be reimbursed for such service at the rate of 3 per cent. of the cost of the installation, with a minimum charge of $10.00, unless the member preparing the plans and specifications should be awarded the contract for the installation, in which case such charge shall be omitted."

It is stated that many architects and engineers customarily furnish clear, complete, fair and ably-constructed plans and specifications, but that there are other architects and engineers who, when calling for bids upon the installation of a mechanical, or direct radiation system, furnish the heating contractor with a set of the general building drawings and expect him to design a heating system, including size, location and design of radiators, size and location of piping, size of boiler and all other essential features of the system. This being done, the heating contractor is expected to write a specification, make his estimate of the cost of construction and submit his proposal, accompanied by the plans and specifications which he has prepared. Thus, in the case of the average job, from six to a dozen plans and specifications are prepared, with the opportunity for but one to be utilized.

As a result it is claimed that the heating contractor must do much engineering work for which he cannot expect to receive any direct remuneration.

Annual Meeting of Eastern Supply Association.

The Eastern Supply Association held its annual meeting in New York, October 20, when the following officers were elected:

President, L. O. Koven, L. O. Koven & Brother, New York; first vice-president, G. R. Adams, Samuel Sloan & Co., Rochester, N. Y.; second vice-president, Joseph F. Evans, Wyoming Valley Supply Co., Wilkes-Barre, Pa.; treasurer, Martin Behrer, Behrer & Co., New York; secretary, Frank S. Hanley, New York.

Board of Directors: Above officers and W. L. Blake, W. L. Blake & Co., Portland, Me.; James F. Conran, Standard Sanitary Mfg. Co., Pittsburgh, Pa.; J. P. McPhail, James Robertson Mfg. Co., Baltimore, Md.; John A. Murray, John A. Murray Co., New York; F. T. Stevens, Plimpton & Hills Corporation, Hartford, Conn.; H. W. Thorndike, F. W. Webb Mfg. Co., Boston; and A. A. Tomlinson, Virginia-Carolina Supply Co., Norfolk, Va.

The following were elected members of the national committee: A. M. Maddock, Trenton, N. J.; Philip Speakman, Wilmington, Del.; F. W. Hubbard, Boston, Mass.; S. E. Hunting, Rochester, N. Y., and Walter Walls, Philadelphia.

Representative to the National Chamber of Commerce: P. M. Beecher, Syracuse, N. Y.

Addresses were made by Joseph F. Evans of the Wyoming Valley Supply & Mfg. Co., of Wilkes-Barre, Pa., on "Trade Loyalty," and by G. R. Adams of Samuel Sloan & Co., Rochester, N. Y., on "Better Business Building Blocks." After a discussion of the question, "Is it advisable or desirable for both manufacturer and jobber to have the manufacturer make prices to the jobber carrying a discount of 6 or 7 per cent. for payments ten days from date of invoice?" it was voted to have a committee canvas both manufacturers and jobbers on the advisability of having both branches of the trade co-operate in establishing such a rate of discount. Other speakers were H. H. Sommer, of the American Plumbing Mfg. Co., Brooklyn, N. Y., who urged the elimination of items from estimates; and J. B. Chambers, treasurer of the Pierce, Butler & Pierce Mfg. Corporation, and of the Kellogg-Mackay Co., who read a paper on "Reciprocating Credit Reporting," suggesting the establishment of an association bureau for the exchange of credit information.

The election to membership was announced of the McNab & Harlin Mfg. Co., New York; Republic Iron & Steel Co., Pittsburgh, and the Walworth Mfg. Co., Boston.

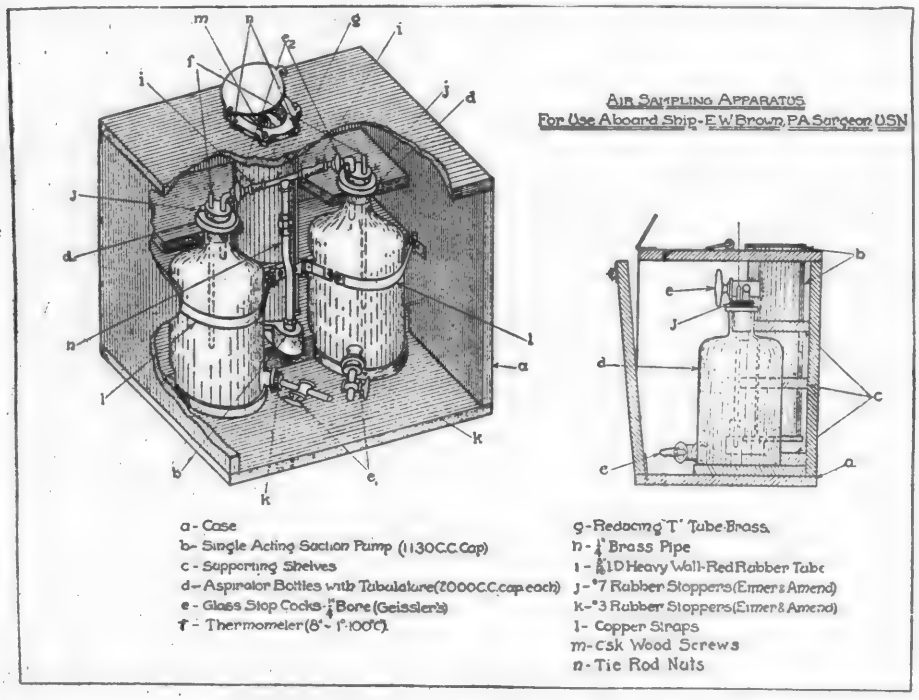
NEW DEVICES

A Portable Air Sampling Apparatus for the Collection of Large Volumes.

The apparatus here described has been designed for the rapid collection in duplicate of relatively large volumes of air to be examined in the laboratory for such gases as carbon monoxide, hydrogen sulphide, oxides of nitrogen, etc. Minute amounts of these gases are of hygienic significance when standard methods of analysis require the aspiration of large quantities of such air through appropriate absorbents. It is not practicable, as a rule, to make the analysis on the spot, particularly if the air is rapidly changing in composition, owing to the time required for aspiration and the special apparatus necessary to complete the analysis. A situation might arise, for example, in a sewer or in an engine room, when it is imperative to take large samples speedily so that a representative portion within a short-time interval may be obtained. The advantages of collection in duplicate are obvious. The present apparatus is designed to fulfill such requirements.

The apparatus is portable, protected against breakage under shipment, and airtight. It consists of a wooden case, 17 in. long, 12 in. deep and 14½ in. high, enclosing two glass bottles each of 2,000 cc. capacity, with gas-tight stopcocks, and fitted with a standard thermometer. The bottles are connected by glass and metal tubes with the inlet of a brass suction pump of special design. The writer has determined on the basis of a large number of tests that each stroke of the suction pump draws about 800 cc. of air through the two bottles at the rate of about one stroke per second. This was observed by connecting the two lower stopcocks to a gas holder and exhausting a definite quantity of air from the latter through the bottles with the pump. The course of the air in sampling is as follows: Through stopcocks e 1 to bottles, through stopcocks e 2 to the reducing T-tube g to h and to pump. The bottles rest on felt pads and are held firmly in place by copper straps encased in felt. The rubber stop-

pers are carefully wired in place. The pump is readily accessible for interior inspection. There is an outside carrying case provided for shipment, not shown in the sketch. This has a protective arrangement of springs at the bottom and also on the under side of the cover; the sides, cover and bottom are covered with very hard felt padding. The inside case is, therefore, guarded against any sudden jar in handling and no further packing material is needed. Thorough tests for tightness were made. There may be, of course, marked changes in pressure of the contained sample as a result of temperature variations; thus, a drop from 70° F. to 32° F. would entail a fall in pressure of over 2 in. of mercury. The apparatus remained perfectly tight under a positive and negative pressure of 6 in. of mercury, which is far in excess of any possible fluctuation.


Air Sampling Apparatus
For Use Aboard Ship - E. W. Brown, P.A. Surgeon USN
a - Case
b - Single Acting Suction Pump (1130 C.C. Cap)
c - Supporting Shelves
d - Aspirator Bottles with Tubulature (2000 C.C. cap each)
e - Glass Stop Cocks - ¼" Bore (Geissler's)
f - Thermometer (8° - 1° 100°C)
g - Reducing 'T' Tube Brass
n - ¼" Brass Pipe
i - ¼" ID Heavy Wall Red Rubber Tube
j - #7 Rubber Stoppers (Emer & Amend)
k - #3 Rubber Stoppers (Emer & Amend)
l - Copper Straps
m - Csk Wood Screws
n - Tie Rod Nuts

PORTABLE AIR SAMPLING APPARATUS.

DIRECTIONS FOR SAMPLING.

Open stopcocks e 1 and e 2; give 20 strokes to the pump, and close all stopcocks securely. If it is desired to sample from a place where it is impracticable to place the instrument, carry rubber tubing connections from stopcocks e 1 to the location specified.

PRECAUTIONS.

Securely wire all stoppers to tubulatures of bottles; lubricate all stopcocks, and secure with rubber bands; wire all rubber tubing connections; inspect interior of pump from time to time as to condition of valves.

The following question arises: How many strokes of the pump are necessary to obtain a representative sample of air? The combined volume of the two bottles is 4,000 cc., and the air displacement of the pump is 800 cc.; thus, in five strokes, 4,000 cc. of air would pass through the apparatus, but the sample would still be contaminated by a small residual portion of the original air. This question was tested by the following procedure: The sampling bottles were connected through stopcocks e 1 by rubber tubing of ¼-in. internal diameter, with two openings into the interior of an air-tight respiration chamber of 300 ft. capacity, the CO_2 content of which had been previously determined by a Haldane gas analysis apparatus. A sample was then drawn from the chamber into the two bottles, using a definite number of strokes with the pump, the stopcocks then closed and CO_2 estimated in each bottle by the Haldane apparatus. The CO_2 percentage of the room and the number of strokes of the pump were varied from time to time. The data in the following table are typical of the results obtained. Each percentage

represents an average of three analyses agreeing within 0.02%.

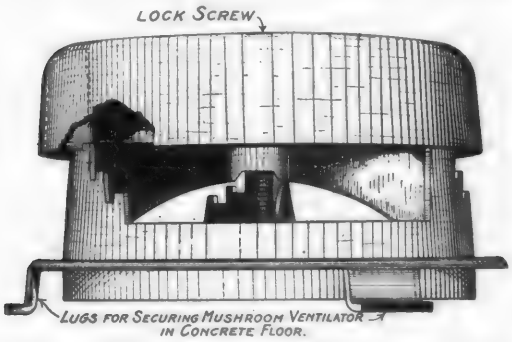
It is concluded from the accompanying figures that a minimum of 15 strokes of the pump are required to obtain a representative sample; but 20 to 25 strokes are recommended to allow a proper margin of safety.

Air-tight room, avg. CO_2, per cent.	Bottle 1, avg. CO_2, per cent.	Bottle 2, avg. CO_2, per cent.	No. strokes of pump.
0.78	0.73	0.74	10
0.24	0.18	0.20	10
0.24	0.20	0.20	10
0.26	0.20	0.21	10
0.26	0.19	0.20	10
0.52	0.47	0.45	10
0.80	0.81	0.79	15
0.57	0.56	0.56	15
0.23	0.21	0.21	15
0.24	0.23	0.22	15
0.27	0.25	0.24	15
0.24	0.22	0.23	15
0.25	0.25	0.27	15
0.27	0.26	0.25	15
0.25	0.25	0.25	15

—E. W. Brown, Past Assistant Surgeon, U. S. Navy, in the American Public Health Association's "Journal."

Trade Literature.

PERFECT VENTILATION THROUGH DISTRIBUTION, featuring the Knowles mushroom diffuser and air controlling head, is brought to the attention of the trade through a timely circular illustrating and describing the various types of this air diffuser. A notable list is given of the buildings in which the Knowles



CONSTRUCTION OF KNOWLES MUSHROOM VENTILATOR FOR USE ON CEMENT FLOORS.

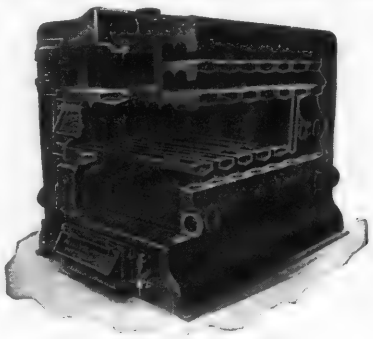
device has been installed. A suggestion is also included for using the Knowles mushroom air diffusers in ventilating a motion picture theatre. This device, which is intended to be placed directly underneath the seats in a hall or auditorium, may be used with equal effectiveness with up-draft or down draft. The Knowles Mushroom Ventilator Company, 9 Church Street, New York, manufacturer of the devices, announces that it has just perfected a new method of securing the air diffuser to cement floors. Instead of the screw-eye lugs which are ordinarily used on wood floors, cast-iron projections have been provided from the floor flange extending down 1 in., so that, when set, the top dressing of cement will cover the same, making a simple, but solid, connection. Size of catalogue 3½ x 6½ in. Pp. 16.

OSWEGO INTERNALLY FIRED WATER TUBE BOILERS, made by the A. D. Granger Company, 90 West Street, New York, are the subject of a newly-issued catalogue. It is stated that the boiler occupies the smallest space per horsepower of any boiler built, that it will show a maximum fuel economy, that no case of failure has ever been recorded or known, and that it is a rapid steamer. The inner and outer shell form a complete water jacket surrounding the fire, absorbing the radiant heat and eliminating the loss of heat in the brickwork of a brick-set boiler. The front and back water spaces are connected by straight inclined tubes so that the circulation is from the coolest to the hottest portion of the boiler. These tubes can be drawn forward when being renewed, into the firing space, so that no additional length to the rear of the boiler is required for this purpose. The company's line includes twenty-two types, ranging from 20 H.P. to 300 H.P. The high pressure line includes those built for a working pressure of 100 lbs. or over. The low pressure or steam heating boilers include all boilers for a working pressure up to 66 lbs. per sq. in., although the test pressure for all boilers of this class is 100 lbs.

OSWEGO WATER TUBE BOILER.

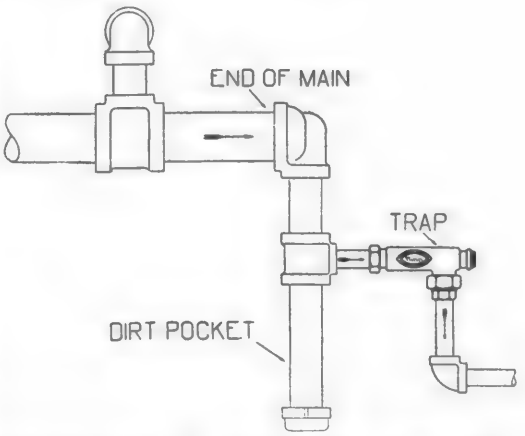
Attention is called to the low water line of these boilers, the boilers being especially designed for use with gravity systems. The Oswego boiler is also made with Dutch oven settings, with the combustion chamber arranged for bituminous coal, or oil fuel, and for either hand firing or mechanical stokers. Down-draft water grates are also supplied for smokeless combustion of fuel. Size 8 x 10½ in. Pp. 14.

PEERLESS PATENTED STEAM AND WATER BOILERS, known for their patented S-shaped water tubes or braces and for the cup-shaped design of their crown plates which are designed to add to their heat efficiency and quick steaming qualities, are the subject of a well-prepared catalogue issued by the Peerless Heater Company, Pittsburgh, Pa. The crown plate is made up of sixteen 3-in. cup-shaped or hemispherical arches, resulting in a notable increase of heating surface without increasing the volume of water to be heated. In connection with the S-tube feature of the water tubes or braces it is pointed out that they are so made, with a reverse curve, to avoid failure due to the strains incident to expansion when hot. In addition to its regular line, the company offers a line of smokeless boilers of the same general design, but equipped with down-draft water grates in addition to which is embodied the patented S-arm interior construction. The catalogue concludes with some noteworthy testimonials from satisfied users. Size 6 x 9 in. (standard). Pp. 40. Supplementing the catalogue, the company is sending out a test sheet giving details of a 24-hr. test on a Peerless down-draft smokeless boiler, conducted by Champlain L. Riley, of Clark, MacMullen & Riley, consulting engineers, New York, which showed, among other things, an efficiency of 67.9%, a water evaporation per pound of dry coal of 8.75 lbs. and an equivalent evaporation from and at 212° F. per pound of dry coal of 10.2 lbs.



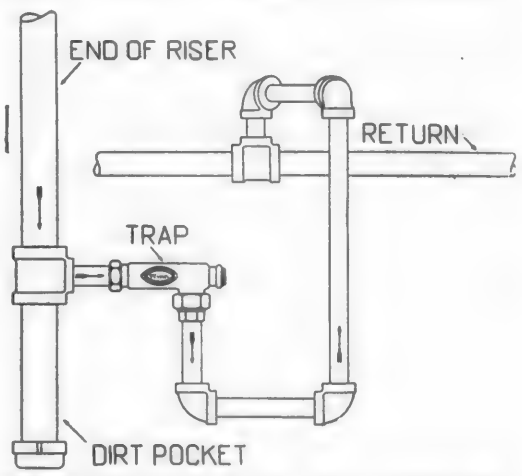
PEERLESS HEATER.

WINN LOW PRESSURE EXPANSION STEAM TRAP AND ITS APPLICATION is the subject of a recent bulletin received from the Shaw-Kendall Engineering Co., Toledo, O. In its general construction the trap follows the lines of the Winn radiator trap, which was illustrated in our columns for May, 1915. The low pressure trap is designed especially to meet the demands where large volumes of water and air are to be taken care of. The expansion element is longer than in the radiator trap, giving a larger clearance through the valve opening. The inlet of trap, also, is directly opposite to that of the radiator trap, the expansion element closing off against the flow of the steam, instead of with it, which has been found the best method when used for dripping mains, steam risers, indirects, fan blast coils, etc. Size 6 x 9 in. (standard). Pp. 4.



APPLICATION OF WINN TRAP DRAINING END OF STEAM MAIN.

STURTEVANT TURBO-UNDERGRATE BLOWER, to increase the furnace draft and permit cheaper coal to be used, is brought to the attention



APPLICATION OF WINN TRAP DRAINING RISER.

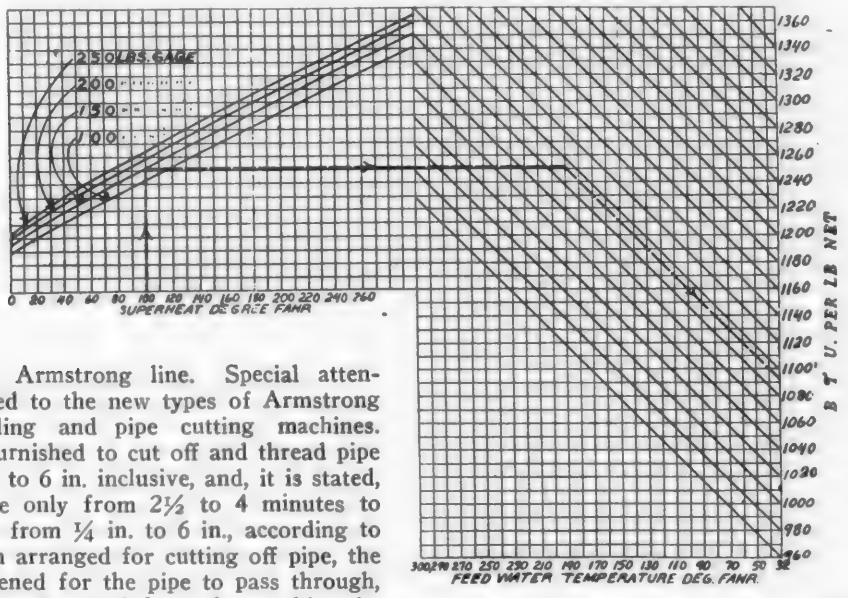
of the trade in a new circular published by the B. F. Sturtevant Co., Hyde Park, Mass. Where additional boiler capacity is contemplated, the turbo-undergrate blower is especially valuable as it may make additional boilers unnecessary, while at the same time it can be equipped with more steam nozzles should the work become heavier or the steam pressure less.

THE PITOT TUBE AND FAN TESTING, which was referred to in a number of recent discussions at meetings of the Heating Engineers' Society, has been issued as a second edition of Bulletin 35, Series 1, by the American Blower Company, Detroit, Mich. In addition to describing the development and testing of "ABC" Pitot tubes, the bulletin contains much valuable information regarding other Pitot tubes and meters, and also methods of conducting fan tests. This is followed by data showing the calculations that are necessary, the latter being supplemented by air and psychrometric charts and tables. Size 7½ x 11 in. Pp. 32.

GENUINE ARMSTRONG STOCKS AND DIES, water, gas and steam fitters' tools and pipe threading machines, manufactured by the Armstrong Mfg. Co., Bridgeport, Conn., are the subject of a new catalogue devoted to the well-known Armstrong line. Special attention is called to the new types of Armstrong pipe threading and pipe cutting machines. They are furnished to cut off and thread pipe from ¼ in. to 6 in. inclusive, and, it is stated, they require only from 2½ to 4 minutes to thread pipe from ¼ in. to 6 in., according to size. When arranged for cutting off pipe, the dies are opened for the pipe to pass through, without being removed from the machine, by a motion of the hand wheel or lever. The gears and bearings are enclosed in an oil chamber, thus preventing chips or dirt from getting into the working parts. A newly-patented attachment is included in several of the types whereby the cutting off of pipe is done automatically. Size 6 x 9 in. (standard). Pp. 56.

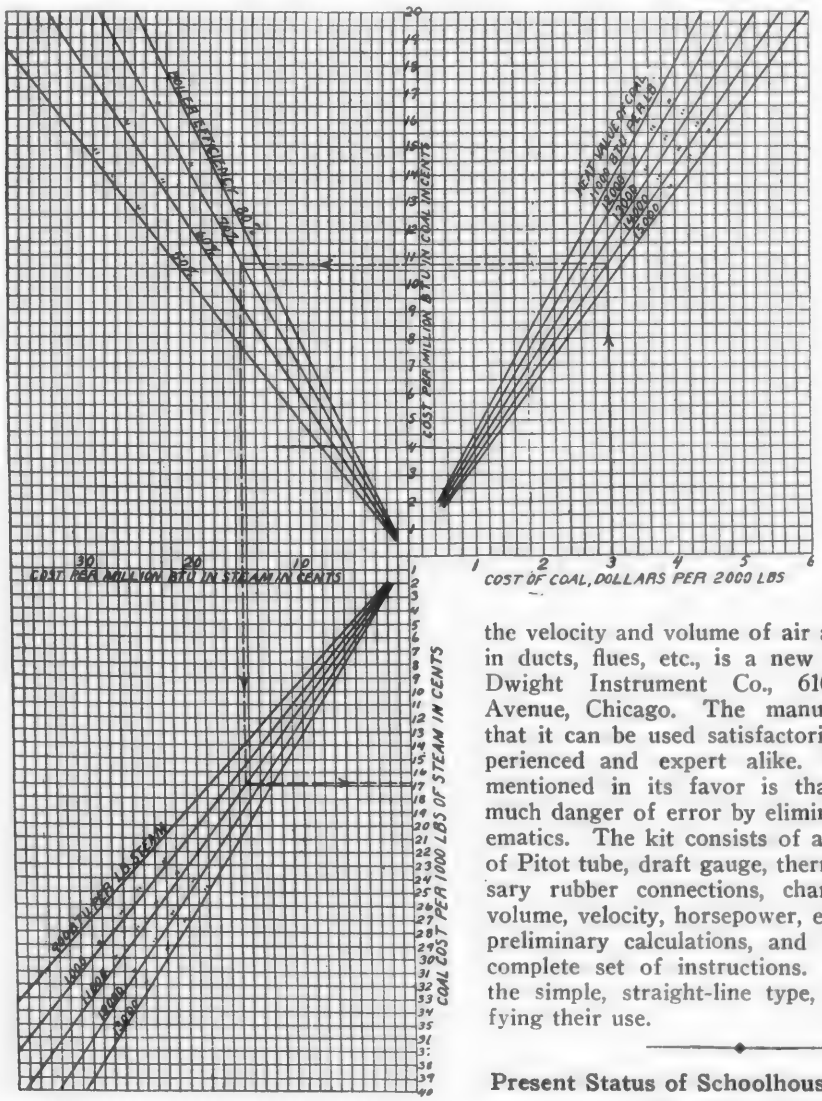
C. & C. MOTORS, made by the C. & C. Electric & Mfg. Co., Garwood, N. J., are featured in new circular matter illustrating the lower section of New York, and entitled, "The most remarkable group of buildings in the world is equipped with the old reliable C. & C. motors." It is also stated that C. & C. motors aggregating a total of 2,650 H. P. are installed for driving air compressors, pumps and blowers in the New York subway, East River tunnel and Hudson River tunnels. The circular contains a double-page photographic view of the Grand Central Terminal in New York, where 122 C. & C. motors aggregating over 5,000 H. P. are installed.

THE COST OF PUMPING WATER is the title of a collecting of graphical charts with accompanying explanatory text issued by the De-Laval Steam Turbine Co., of Trenton, N. J. The object of the publication is to facilitate computation of the overall economy of different types of steam pumping units, having given the cost of fuel, steam pressure, rate of interest, cost of apparatus and other variables. The first chart shows the number of B. T. U. represented by each pound of steam for various combinations of superheat, steam pressure and feed water temperature. The second chart gives the cost of 1,000 lbs. of steam and the cost of a million B. T. U. in the steam from the cost of coal per ton, the heat value of the coal and the boiler efficiency.



HEAT UNITS RECEIVED FROM FUEL PER POUNDS OF STEAM FOR VARIOUS STEAM PRESSURES, SUPERHEATS AND FEED WATER TEMPERATURES.

The third diagram shows the relation existing between the average cost of steam turbine-driven centrifugal pumping units and the head pumped against. The fourth diagram shows the amount of money to be set aside yearly for sinking fund, to cover depreciation for different terms of life and rates of interest. The fifth diagram is the well known Mollier


COST PER MILLION B.T.U. IN COAL IN CENTS
COST OF COAL, DOLLARS PER 2000 LBS
COST PER MILLION BTU IN STEAM IN CENTS
COAL COST PER 1000 LBS OF STEAM IN CENTS

COST OF HEAT AND STEAM FOR VARIOUS FUEL COSTS, HEAT VALUES, BOILER EFFICIENCIES AND STEAM CONDITIONS.

velocity of steam in feet per second and the corresponding duty in foot pounds per 1,000 steam chart supplemented by a convenient scale by means of which B. T. U. available per pound between given limits, the resulting lbs. of steam, and the pounds of steam per H. P. hour may be read off directly. The sixth diagram is an alignment chart for determining the resistance of pipes to flow of water. At the end of the publication is a list of representative municipal installations of DeLaval steam turbine-driven centrifugal pumps. Size 6 x 9 in. Pp. 8.

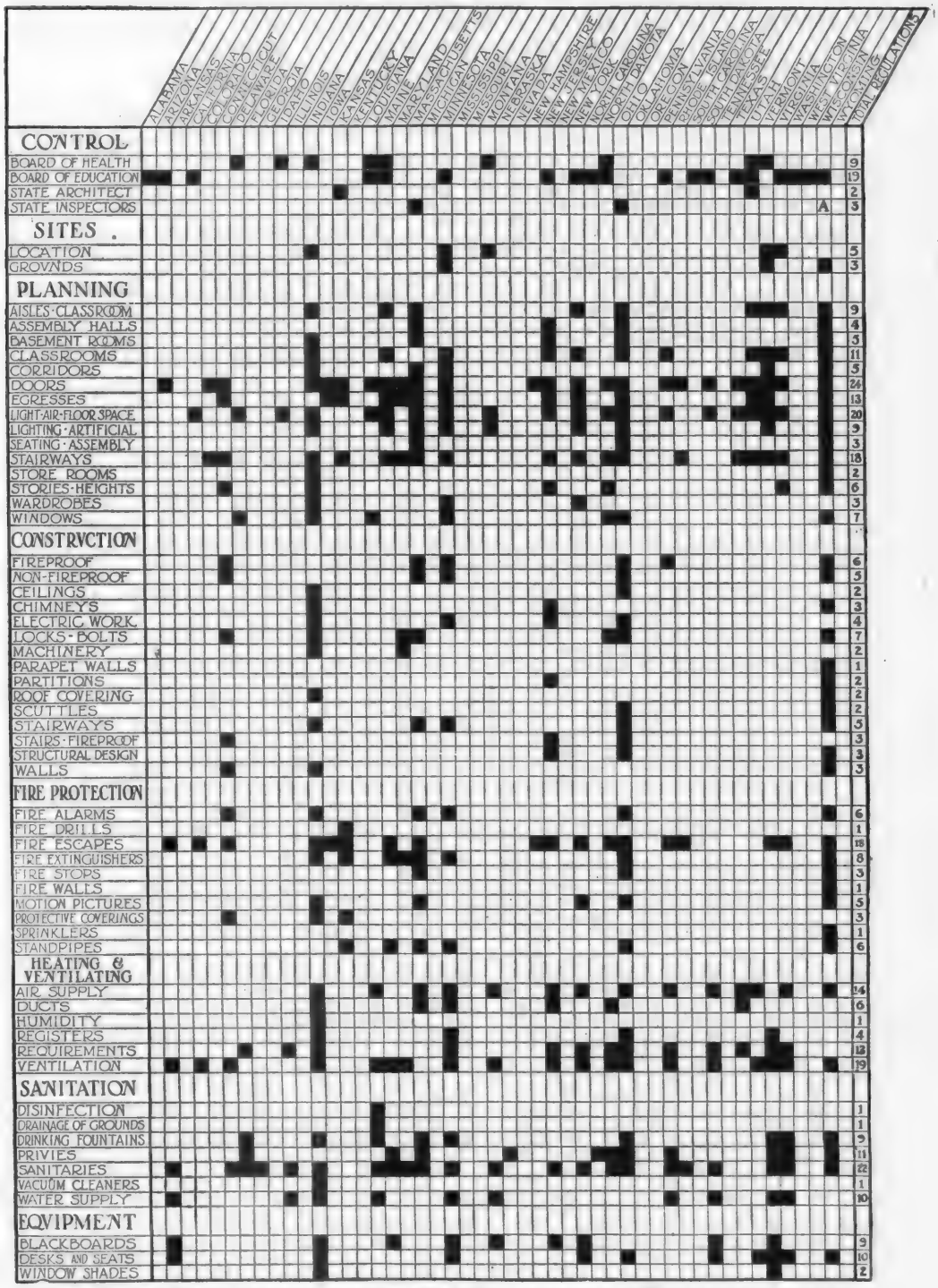
GILBERT AIR MEASURING KIT, for measuring the velocity and volume of air and other gases in ducts, flues, etc., is a new product of the Dwight Instrument Co., 6100 Greenwood Avenue, Chicago. The manufacturers state that it can be used satisfactorily by the inexperienced and expert alike. Another point mentioned in its favor is that it eliminates much danger of error by eliminating all mathematics. The kit consists of a standard form of Pitot tube, draft gauge, thermometer, necessary rubber connections, charts for finding volume, velocity, horsepower, etc., without any preliminary calculations, and there is also a complete set of instructions. Charts are of the simple, straight-line type, further simplifying their use.

Present Status of Schoolhouse Construction in the United States.

New data on schoolhouse construction in the United States are contained in the accompanying chart, compiled by Frank Irving Cooper, of Boston, and published in Safety Engineering for August. The chart in the general form here presented is similar to the one originally designed by Mr. Cooper and published in THE HEATING AND VENTILATING MAGAZINE for April, 1911, covering the regulations in force at that time.

CHART SHOWING STATUS OF REGULATION OF SCHOOLHOUSE CONSTRUCTION IN THE UNITED STATES IN THE YEAR 1915

COMPILED BY FRANK IRVING COOPER, ARCHITECT BOSTON.



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■ INDICATES REGULATION IN FORCE.

Current Heating and Ventilating Literature.

Under this heading is published each month an index of the important articles on the subject of heating and ventilation that have appeared in the columns of our contemporaries. Copies of any of the journals containing the article mentioned may be obtained from THE HEATING AND VENTILATING MAGAZINE *on receipt of the stated price.*

CENTRAL HEATING—

Central Heating. Charles L. Hubbard. Compared with small individual heating plants. 2,000 w. Nat. Engr.—Aug., 1915. Serial, 1st part. 20c.

COOLING SYSTEMS—

Getting the Proper Vacuum in Summer. J. Wilmore. Characteristics of cooling systems, requirements and designs. Ills. 4000 w. Elec. Wld.—Aug. 14, 1915. 20c.

GAS RADIATORS—

Efficiency of Gas-Fire Radiators. Editorial on the methods of determining, especially the bolometer described by W. A. Bone, and H. L. Collendar, with H. James Yates. 1600 w. Engng. Aug. 6, 1915. 40c.

HEATING PLANTS—

Heating and Ventilating Large Factories. O. H. Bathgate. Operation of a large industrial plant. Ills. 2200 w. Elec. Jour. —Aug., 1915. 20c.

Panama-Pacific International Exposition.

9—J. H. WILLIAMS & CO.

The highest award for drop-forged tools at the Panama-Pacific International Exposition was awarded to J. H. Williams & Co., of Brooklyn, N. Y.

The exhibit is enclosed on three sides by a fence composed largely of various sizes and styles of chain pipe wrenches against which rest large sample boards bearing the drop-forged products for which the company is so well known. In the immediate center stands a duodecagonal cycloram from the roof of which rises an extended forearm with hand clasping a wrench. Walls composed of sample boards carrying a large variety of special forgings and forged tools revolve constantly. Above these boards are engravings illustrative of the progress made by the forging industry since its inception.

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TRADE AND MISCELLANEOUS NOTES

Coming Events.

Nov. 17-18, 1915—Annual convention of the National Founders' Association, New York. Headquarters at the Hotel Astor.

December 7-10, 1915.—Annual meeting of The American Society of Mechanical Engineers, at the Engineering Societies Building, 29 West 39th Street, New York.

January 12-15, 1915.—Winter meeting of the American Institute of Chemical Engineers, in Baltimore, Md.

Miscellaneous Notes.

Los Angeles, Cal.—Edgemont will shortly enjoy the distinction of being the only city in the State or Northwest which has buildings heated by hot water from an artesian well. The famous hot water spouter which was completed at that place some months ago will be utilized to heat the buildings in the business district.

Seattle, Wash.—The question of heating the new court house building by a plant of its own, or whether steam heat will be purchased from the Puget Sound Traction, Light & Power Co., is before the board of county commissioners. The board has found that it would be cheaper to buy steam, but has not given up the individual plant idea. The cost of an individual plant is estimated at $19,000, $8,500 of which would go for excavation and concrete work. The annual cost of operating such a plant, including the interest on the investment, etc., and salaries of an engineer and two firemen, would amount to about $8,120. Steam could be bought for $6,120 a year.

Dallas, Tex.—Governor Ferguson of Texas has granted a deficiency fund of $10,000 for the erection of an up-to-date heating and power plant for the State Training School for Boys in Gatesville. An oil pipe line will be built to Gatesville and oil will be used for fuel in the future.

Rock Island, Ill.—A $12,000 heating plant is included in the budget of the board of supervisors of Rock Island, to be installed in the court house and jail.

St. Paul, Minn.—A correspondent of the St. Paul News asks: "Is there a law prohibiting anyone from putting up their own heating plant, or does it have to be inspected?" The News states that there is no such law in Minnesota and that low pressure plants do not have to be inspected.

Seattle, Wash.—Seattle is to have its first electric-heated school, as a result of the action of the school board in voting permission to install an electric heating plant in a portable at the new Walla Walla school as an experiment and without cost to the district.

Dr. E. Vernon Hill, of the Chicago division of ventilation, department of health, has been elected president of the Chicago commission of ventilation. Other new officers elected are: Vice-president, James H. Davis; secretary-treasurer, Prof. John W. Shepherd. The commission is composed of twelve members. Committees were also appointed to take up the work of the commission for the year.

National Association of Master Plumbers will have the following board of directors, according to an announcement of President James S. Cassedy: S. Louis Barnes, Phila-

Genuine Armstrong Stocks and Dies

MALLEABLE HINGED PIPE VISES

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PIPE MACHINES, HAND OR POWER

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Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

delphia; Frank J. Fee, New York; John T. Trainor, Baltimore; C. J. Herbert, Chicago; William F. Eckart, Seattle, Wash.; J. B. Collins, Houston, Tex.; L. McNamara, St. Louis, Mo.; Henry Green, Salt Lake City; Alexander Coleman, San Francisco; Jacob Schuh, Milwaukee, Wis., and W. S. Loftis, Atlanta, Ga.

Building operations for September, 1915, showed a gain of 32% over the corresponding month in 1914, according to the American Contractor. In a list of 65 cities tabulated, the figures amounted to $54,965,052, as against $41,530,254 for last year. Chicago had a gain of 74%; Cincinnati, 90%; Cleveland, 10%; Indianapolis, 205%; Milwaukee, 145%; Louisville, 115%; Newark, 186%; Philadelphia, 162%; San Francisco, 31%, and Washington, 374%. Losses were reported by New York City of 7% and by St. Paul of 55%.

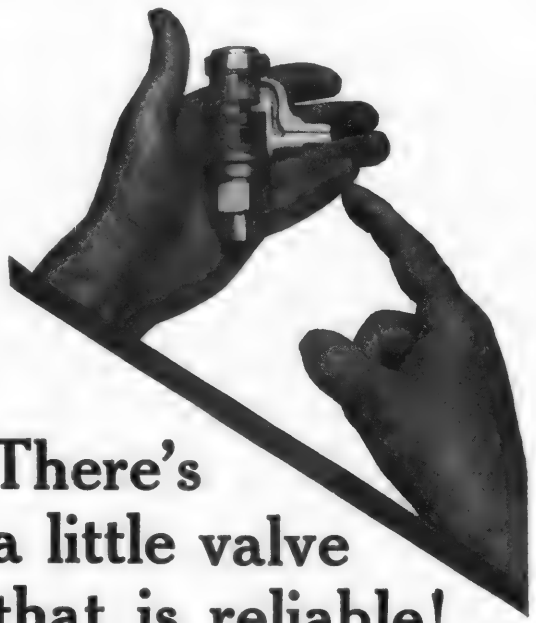
A. J. Lowndes, Roanoke, Va., has started a sales engineering business in Baltimore, Md., handling all kinds of supplies and material for heating work only.

American Foundrymen's Convention, held in Atlantic City, September 26-October 1, elected the following officers: President, R. A. Bull, Commonwealth Steel Co., Granite City, Ill.; secretary-treasurer, A. O. Backert, The Foundry, Cleveland, O.; senior vice-president, J. P. Pero, Missouri Malleable Iron Co., East St. Louis, Ill.

Central Station Heating Notes.

Streator, Ill.—The Public Service Company has applied to the Illinois Public Utilities Commission for permission to advance its rates for heating service. In commenting on this action the Streator Times states that a majority of the heat users declare that it costs more to be served with heat from the central plant than if individual plants were installed, but that most of such users prefer to pay the additional cost rather than to have the care of individual heating plants on their hands. The matter was to be taken up by the Streator city council.

Lebanon, Ind.—As a result of numerous complaints registered with the Interstate Public Service Co., regarding certain raises in the heating rates which were proposed by the company, the company has assigned special men to make remeasurements of Lebanon homes and business houses where the radiation has been pronounced to be faulty. At a recent meeting of the Lebanon Business Men's Association, Virgil Buntin, business manager, was authorized to bring an expert to Lebanon to make measurements of radiation required to heat certain



There's a little valve that is reliable!

IT'S a VacUstat, and is reliable in more ways than one—first of all it is reliable in the sense that you can depend on it to work right and perform its functions properly **always;** and again it is reliable because it is one of the RELIABLE Vacuum Heating Specialties.

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The VacUstat is a thermostatic valve, which automatically keeps the radiators, piping and boiler free from air, prevents escape of steam and insures quick, thorough and even heat circulation, by making every radiator fully efficient. The VacUstat has larger venting capacity, is entirely different and far superior to any other air valve. VacUstats are part of the RELIABLE Air Line Vacuum Heating Equipment, which is used to perfect steam heating plants and to save fuel. Being properly and permanently adjusted at our factory, VacUstats can be installed quickly and at unusually low cost, and after installing VacUstats it is not necessary to go back to the job to make other adjustments.

Install VacUstats—insist on using them—and both you and your customer will be perfectly satisfied with the results.

RELIABLE Heating Specialties—Electric and Hydraulic Vacuum Pumps, VacUstats, Vacu-Traps, Vacu-Graduate Packless Valves, "4-V" Valves, Vacu-Checks, etc.—are Standardized and Staple, and carried in stock by most representative jobbers.

The RELIABLE Heating Equipment catalog will interest you—write for a copy today! Ask for Booklet "K"

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General Offices, CLEVELAND, OHIO

New York Chicago Milwaukee Cincinnati
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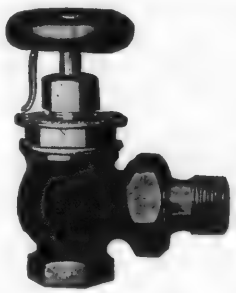
Lebanon homes and stores properly. Before doing this, however, Mr. Buntin consulted with Mr. G. J. Oglebay, local superintendent of the Interstate Public Service Co., and the latter decided that the Interstate company would assume the responsibility of making new measurements for all heat patrons who had complained that they were overcharged on the basis of the radiation required. The Interstate company had been taking measurements during the summer, and in many cases the homes were said to be "underset" and more radiation was deemed necessary. The heat bill was consequently higher and the company announced that charges would be made for heating on the basis of the radiation required. Later on the company announced that those homes which were over-radiated would not be charged for the entire amount of radiation, but only for that which was necessary to heat the home, in the estimation of the company. Paul Helm, now in the offices of the Interstate company, was assigned to make the remeasurements.

Springfield, Minn.—The business men of Springfield have financed a plan to install a central heating plant in that place. The proposition has been agitated for some time, and recently the village engineer, L. A. Larson, of St. Paul, drew up plans and specifications for a central heating plant. Bids received for the construction of the plant ran from $10,000 up. The city council did not feel that it could go ahead with the proposition at that figure and the matter was referred to the business men of the village. A meeting was called and it was agreed that the business men would sign a joint note for $10,500, to be negotiated at the local bank and the proceeds turned over to the village for the purpose of installing the plant. It was agreed that all moneys collected through the sale of heat should be applied monthly toward the payment of the interest and principal of the notes. After the indebtedness is liquidated, it is agreed that the plant is to become the unencumbered property of the city. The plant, which is now under construction, will have mains extending from the powerhouse down Marshall Street to the Free Press Building, and possibly further on Redwood Street.

Cleveland, O.—Acting on a statement made by Utilities Director Stage, that the municipal heating plant at Fairmount Station has been a heavy loser since it was started three years ago, the board of control has authorized an increase in rates. The income, it was stated, has not been sufficient to pay the interest on the bonds nor to pay the employees. The increase granted is 20%, which brings the prices to 35 cents per 1,000 lbs. for the first 300,000 lbs. of steam heat supplied; 30 cents per 1,000 lbs. for 1,200,000 lbs. or more; and 25 cents per 1,000 lbs. for 1,500,000 lbs. or more. Under the new rates the average price received by the city will be in the neighborhood of 33 cents per 1,000 lbs. The new rates became effective October 1. It was admitted by those in charge of the plant that the receipts have been 5 cents per 1,000 lbs. less than the cost of manufacture for the heat supplied to customers in the vicin-



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For use in connection with Atmospheric, Vapor, and Vacuum Return Line Systems.

Open wide in five-sixths of a turn. Opening is correctly graduated and partial heating of the radiator is easily controlled. The large and plainly marked indicator plate is adjustable and marking can be set to any point in the circle. The Jenkins Bros. Disc. standard of design, metal and workmanship, is an assurance of quality and satisfaction.

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THE FOXBORO COMPANY Succeeding The Industrial Instrument Co.

New York Chicago FOXBORO, MASS., U. S. A. San Francisco St. Louis

ity of Euclid Avenue and East 105th Street, where the municipal steam lines are located.

Cleveland, O.—The state public utilities commission has handed down an order directing the Cleveland Electrical Illuminating Co. to extend its mains for steam heating service to the new Cleveland city hall, on condition that the city enter into a contract with the company to use its service for not less than 10 years. The company had previously refused to comply with an ordinance to that effect passed by the city council, claiming, among other things, that it had not enough steam for that purpose unless it could sell additional light, the steam being a by-product from the manufacture of electric current. The city is using its own current for the city hall. The matter became the subject of a sharp controversy which was aired at a hearing before the public utilities commission. Those representing Cleveland at the hearing were Mayor Newton D. Baker, Law Director John N. Stockwell, Public Service Director T. L. Sidlo, Lighting Commissioner F. W. Ballard and Assistant Law Director Arthur E. Young. Those present for the company were W. C. Boyle and Frank Cobb. While the matter was pending, the public service director placed an embargo against new extensions of heating mains by the company into sections of the business district, and it was stated that the director had decided to withhold permission for such extensions until the city hall heating question was settled. Following the settlement, this embargo was removed.

Johnstown, Pa.—Work on the burying of its wires by the Citizens' Light, Heat & Power Co. has been practically completed, and notification has been given to property owners on the streets where the wires were placed in conduits to run their wiring systems in the cellars so that connection could be made from that point. The work of removing the poles will be started as soon as the connections with the various properties are completed.

Kirksville Heat Co., Kirksville, Mo., has added new equipment and remodeled its plant to take care of its increased business. New 10-in. mains have been laid in the business district. The plant is stated to be the only one in the state using a hot water system.

Des Moines, Ia.—An attempt has been made by James M. Pierce, acting through Austin Haines, to have the city council reconsider its recent action in adopting a proposed heating franchise in favor of the Des Moines Electric Co., before the submission of the draft to the vote of the people. The claims advanced by Mr. Pierce were (1) that the legal department did not pass upon the legality of the draft, and therefore the council should not have adopted it; (2) that the franchise is in reality several franchises in one, and that the powers granted by it are not clear; (3) that the corporation to whom the franchise will be given, if approved by the people, is not an Iowa corporation nor is it incorporated in compliance with the Iowa laws. According to present plans, the proposed franchise will be submitted to the people for a vote on November 22.

St. Paul, Minn.—The Consumers' Power Co. was awarded the contract for lighting and heating the St. Paul Public Library for a period of 17 months, beginning January 1, 1916, at its bid of $11,250 for power and light and $4,000 for steam, a total bid of $16,250. The St. Paul Gas Light Co. bid a lump sum of $17,680, with an agreement to deduct varying amounts if the building was not occupied by the city until after January 1. The Consumers' Power Co. made separate bids on steam and electricity, with the additional proposal that if meters showed the actual use to be of a smaller amount than the estimate provided, the published rates of the company could be used by the city in making settlement.

Louisville, Ky.—The matter of granting the steam heat franchise in Louisville, it was stated, would have to go over to the new general council which took office November 9.

Manufacturers' Notes.

Standard Regulator Co., New York, is arranging to increase the capacity of its plant by providing a manufacturing space three times the size of its present factory. The company manufactures a line of temperature regulators and other heating specialties.

Consolidated Engineering Co., Chicago, Ill., announces that its New York headquarters are now at 103 Park Avenue, Room 1212, instead of at 114 Liberty Street. Frederick K. Davis, heating engineer, a member of the American Society of Heating and Ventilating Engineers, and secretary of the society's New York Chapter, formerly engineer for the Chamberlin Metal Weather Strip Co., is in charge of the New York office at this new location. William A. Backus, now in the New York office, is associated with Mr. Davis. Roland B. Hall, Jr., of the New York office, has returned to Atlanta where, at the same address, 1217 Third National Bank Building, he will handle the company's business in association with S. H. Smith, Jr., who has

Webster Air Conditioning Apparatus

Webster Air-Conditioning apparatus is constantly demonstrating its capacity, under a wide variety of exacting conditions, to effect and maintain any desired temperature and humidity.

Wherever a highly efficient and thoroughly dependable air-cooling or air-conditioning system is required, Webster apparatus, by reason of exclusive advantages, merits unquestioned consideration.

Widely installed in hotels, restaurants, office and administration buildings, as well as industrial establishments where special air-cooling and air-conditioning problems are to be met.

Our catalogues and engineering force are at your command.
We guarantee results.

WARREN WEBSTER & CO.

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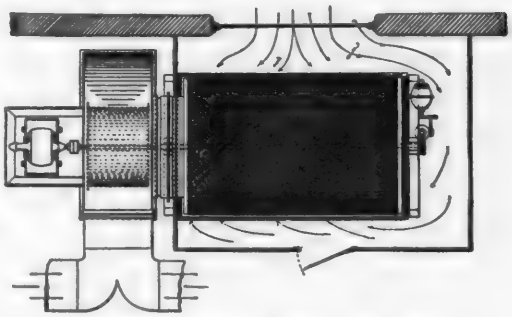
KINGWELTON ROTARY AIR WASHERS

Are manufactured by us to fit any reasonable location and purify any desired volume of air. Upon request, we will gladly inspect any premises in which ventilation of this character is desired and will furnish estimate therefor.



(Patented August 13, 1912) Plan View

The Kingwelton operates at 1/10 of the cost of other air washers, while performing the same service. One revolution per minute requires but 1 H. P. per 50,000 cu. ft. of air supplied per minute. Other volumes in proportion.

Every Detail of Manufacture Has Our Personal Expert Supervision

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been representing the company alone since Mr. Hall's New York connection.

Lavigne Mfg. Co., Detroit, Mich., manufacturer of the Lavigne line of packless quick-opening steam radiator valves, announces the removal of its Chicago branch from Room 800 at 20 East Jackson Boulevard to Room 1004 in the same building. E. W. Sanborn is in charge.

Magee Furnace Co., Inc., manufacturer of the Magee line of boilers and ranges, Chelsea, Mass., is building a new plant in Taunton, Mass., on the Agricultural Fair Grounds, which the company recently purchased. The grounds comprise over seven acres. The company's new foundry will be 500 ft. long and will have a melting capacity of 70,000 lbs. daily. In addition to the foundry building, the new plant will include office and other buildings. Homes for the employees of the company and their families, which number over 500 people, are being arranged for in the vicinity of the factory. The new Magee plant, which will be ready about January 1, will have direct electric freight connections with Boston and surrounding cities. The company's Boston headquarters on Union Street will be maintained as usual.

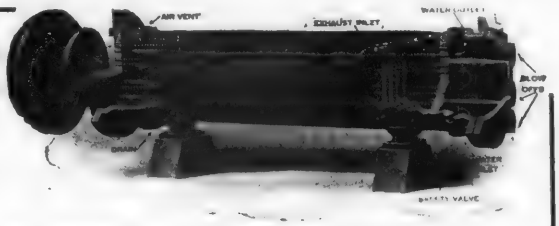
McNab & Harlin Mfg. Co., New York, announces the election of Foster Milliken as president of the company. The company manufactures brass, iron and steel valves, cocks and fittings for steam, water and gas service. Mr. Milliken was formerly president of Milliken Bros., Inc., structural steel and iron manufacturers, whose plant is located on Staten Island.

Bishop-Babcock-Becker Co., Cleveland, O., announces the election of E. S. Griffiths as president of the company, succeeding John Sherwin, resigned.

E. C. Stearns & Co., Syracuse, N. Y., has taken over the business of the National Incinerator Co., New York, manufacturer of the "Incinerite" system for the disposal of household garbage. This system comprises a gas-burning device for the disposal of garbage and other household waste. It has been widely used in hospitals and other public institutions. The device was formerly manufactured by E. C. Stearns & Co. The "Incinerite" is used in the kitchens of the White House at Washington, and serves not only as an incinerator, but also as a waste receptacle. The refuse, wet or dry, is placed in the "Incinerite," and the burners are then lighted. The combustion, aided by the formation of natural gases in the garbage, reduces the mass to fine sterile ash.

John Brennan & Co., Detroit, Mich., whose line of firebox and smokeless firebox boilers has recently been supplemented with a corresponding line of boilers

Correct Engineering Principles
are followed in the construction of the
ALBERGER MULTI-HEAD WATER HEATERS
Horizontal or Vertical



Proper provision is made for expansion and contraction of the tubes. Built of the highest grade materials, consisting of pure copper and cast-iron.

For boiler feed water, gravity and forced circulation heating systems, hot water service for domestic purposes, etc. Catalogue on request.

ALBERGER HEATER COMPANY, BUFFALO, N. Y.
CHICAGO, ILL.

Your Choice of Seven Types
is offered in our line of
Standard Recording Thermometers
We make a specialty of hot water and steam indicators
Send for Catalogue VH
Standard Thermometer Co., Clifton and Shirley Sts., Boston, Mass.

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

9 Sturtevant (REG. U. S. PAT. OFF.) Copper Air Washers In Kansas City Terminal

Sturtevant Multivane Fan and Air Washer, Showing Motor-Driven Circulating Pump. Note glass inspection door.

The air washers in the Kansas City Union Terminal have a combined air capacity of 301,000 cu. ft. per minute. There are two units of capacity 45,000 CFM; three units, 38,000 CFM; two units, 33,000 CFM; one unit, 24,000 CFM; and one unit 14,000 CFM.

All the air washers were guaranteed to humidify to 95% saturation with air leaving the pre-heater at 45°. The required air cleansing efficiency was 98½%.

The air washers have glass doors and observation window, and water-proof electric lights, and they are supplied by motor-driven pumps with water-cooled bearing. They operate in connection with Sturtevant Multivane Fans, of which there are 26 in the building.

Let us send you a catalogue describing the Sturtevant Air Washer

B. F. Sturtevant Company, Hyde Park, Boston, Mass.
And All Principal Cities of the World

equipped with smokebox and smokehood at the rear for economy setting to eliminate the brickwork, have been established in Detroit as boiler makers since 1847. Since that time the company has been actively engaged in building Scotch marine, return tubular, water tube, locomotive firebox and dredge boilers; also portable firebox boilers, traction engine boilers and smokeless firebox boilers. The firm now occupies a modern factory site covering four acres, adjoining the Michigan Central Railroad tracks. The company is specializing on the Detroit smokeless firebox boilers, which, it is stated, are satisfactorily meeting the most rigid smoke ordinances in effect in various cities.

C. A. Dunham Co., Marshalltown, Ia., announces that George E. Griffith has been appointed the company's sales representative in Seattle and northwestern Washington. Mr. Griffith has opened offices at 936 Henry Building, Seattle, where he will handle the Dunham line of vacuum and vapor heating specialties used in the Dunham system of heating.

Business Troubles.

Bush Plumbing Co., Washington, D. C., has filed a voluntary petition in bankruptcy. The liabilities are listed at $10,108 and the assets at $5,956.

Blake & Williams, New York, heating and ventilating contractors, have had a petition in bankruptcy filed against them by these creditors: John H. Ross, $500; Henry E. Pappenberg, $500, and Perry B. Duryea, $500. It was alleged that the company made preferential payments of $396 to two creditors. Judge A. N. Hand appointed William C. Strange and William Smith receivers, with a bond of $5,000, and authorized them to continue the business. The company, which has handled a large number of installations for the New York City public schools, had thirteen contracts under way, amounting in gross to $260,000. Of these the retained percentages were about $50,000. Among the contracts were: Public Schools 95, 169 and 179, Brooklyn, N. Y.; Public Schools 91 and 97, Queens, N. Y.; 8 cottages at Thiels, N. Y.; St. Patrick's Club, Glen Cove, N. Y.; Y. M. C. A. building at Greenwich, Conn.; Hartford municipal buildings; St. John's Home, Brooklyn, N. Y., and D., L. & W. R. R. station at South Orange, N. J. There are about 150 creditors. The business was started as a firm in 1889 and was incorporated on July 22, 1909, with capital stock of $50,000. Francis O. Williams was president and Albert B. Williams treasurer. George Blake, one of the founders of the business, died in 1890.

Southern Heating Co., Memphis, Tenn., has filed a voluntary petition in bankruptcy. One of the largest creditors is Crane Co., whose claim on open account is given as $6,426. The company's liabilities are $12,479 and its assets $9,914.

New Incorporations.

Glen Hope Light, Heat & Power Co., Glen Hope, Pa., capital $5,000. Incorporators: Warren Partridge, W. O. Hoover and J. P. O'Laughlin, Clearfield, Pa.

Farquar Heating & Ventilating Co., Lima, O., capital $10,000. Incorporators: F. B. Easton, James P. Hall, John F. Brenneman, Elizabeth Hall and Laura N. Easton.

R. J. Mercer Co., Traverse City, Mich., capital $12,000, to take over the heating and plumbing business conducted by R. J. Mercer & Co., of that city.

Johnson Heating Co., Detroit, Mich., capital $10,000, to manufacture heating and plumbing specialties. Among the principal stockholders are William K. Johnson and Thomas G. Barbas.

Martens Plumbing Co., Cleveland, O., capital $5,000. Incorporators: J. B. Martens, E. Martens and C. L. Jones.

Soffin Plumbing & Heating Co., Detroit, Mich., capital $4,000. The principal stockholders are Solomon Warren, I. Soffin and S. Berman.

Noland-Clifford Co., Newport News, Va., capital $10,000, to conduct a heating and plumbing business. President, L. U. Noland; secretary, Frank Roth, both of Newport News.

Best Bros. Plumbing & Heating Co., Quincy, Ill., capital $15,000. Incorporators: William D. Best, Seward Best and Lawrence D. Smith.

Chicago Steam Heating Co., Chicago, Ill., capital $2,500, to conduct a heating contracting business. Incorporators: Joseph H. Hedmark, J. B. O'Connell and M. A. Noe.

Gorham Plumbing & Heating Co., Lowell, Mass., capital $5,000. Incorporators: George B. Roche and Charles Hanchett.

Business Chances.

Washington, D. C.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, for the following-named work:

Until Nov. 12, 1915, for the construction complete, including mechanical equipment, etc., of the U. S. Post Office at Salamanca, N. Y. Two stories and basement, 4,800 sq. ft. ground area.

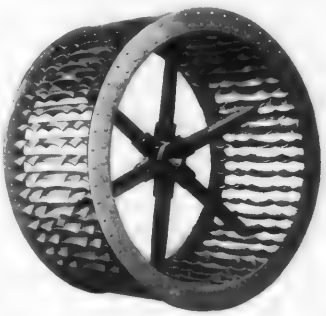
Harvard's Wonderful New Library

The Harry Elkins Widener Memorial Library is truly a wonderful institution, and pre-eminently fitting for the great university which it adorns.

In this beautiful building Sturtevant Multivane Fans are used exclusively for supplying fresh air wherever needed and for exhausting foul air from halls and toilets.

A complete system of distributing ducts below the stacks supplies fresh air to keep the books in good condition. The fresh air outlets are located 10 feet apart.

Photograph shows Harvard Yard Facade of Widener Library—Capacity two and a quarter million volumes—Cost, $2,000,000.00 — Architect, Horace Trumbauer, Philadelphia and New York.



Multivane Fan Wheel

The Sturtevant organization comprises the largest and most capable body of trained fan engineers in the world. They will be glad to co-operate with you.

B. F. STURTEVANT COMPANY

HYDE PARK, BOSTON, MASSACHUSETTS
AND ALL PRINCIPAL CITIES OF THE WORLD

Sturtevant
(REG. U. S. PAT. OFF.)

Until Nov. 19, 1915, for the construction complete, including mechanical equipment, etc., of the U. S. Post Office at Elyria, O. One story and basement, 7,478 sq. ft. ground area.

Until Nov. 29, 1915, for the extension, remodeling, etc., of the U. S. Post Office and Custom House at Muskegon, Mich.

New Firm.

John C. Williams, New York, formerly of Blake & Williams, heating and ventilating contractors, has started a heating and ventilating contracting business as John C. Williams, Inc., with offices in the Woolworth Building, New York. When a journeyman, Mr. Williams installed the first steam heating plants on Long Island, east of Brooklyn, the first in the residence of the late John R. Foster in Babylon and the other in the James Bulger homestead on the South Country Road.

OWNERSHIP NOTICE.

Statement of the ownership, management, etc., required by the Act of August 24, 1912, of THE HEATING AND VENTILATING MAGAZINE, published monthly at New York, N. Y., for Oct. 1, 1915.

Name of Post-Office Address.

Editor, A. S. Armagnac, 1123 Broadway, New York

Managing Editor, none.

Business Manager, Gustave Petersen, 1123 Broadway, New York.

Publisher, Heating and Ventilating Magazine Co., 1123 Broadway, New York.

Owners (if a corporation, give names and addresses of stockholders holding 1% or more of total amount of stock):

Heating and Ventilating Magazine Co., 1123 Broadway, New York.

A. S. Armagnac, 1123 Broadway, New York.

Gustave Petersen, 1123 Broadway, New York.

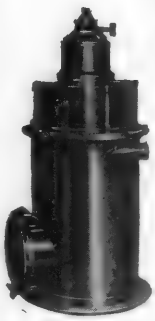
Known bondholders, mortgagees and other security holders holding 1% or more of total amount of bonds, mortgages, or other securities:

None.

(Signed) A. S. ARMAGNAC, Editor.

Sworn to and subscribed before me this 20th day of September, 1915.

(Seal) (Signed) BERTHA ULLMANN,
Notary Public, New York County, No. 3926
(*My commission expires March* 30, 1916.)



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are manufactured in sizes from ¾ H. P. to 40 H. P.

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¼ H.P. Equipment HARTFORD, CT.

MOUAT Graduating Vapor Heating System

Steam and hot water systems can be changed to the Mouat Vapor Heating System by any good plumber or heating contractor.

Here Is a Good Field for Sales

The Mouat Graduating Vapor Heating System enables you to make business where there was no business before.

Write for Booklet, on your business letterhead, and we will give you additional information on how to get this business.

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The Mouat-Squires Co.
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When You Want It
Where You Want It
In Just the Right Amount

Humidity at Low Cost

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SāVō Air Moistener

Can be placed on the back of any radiator, out of sight and will supply the desired amount of moisture to any steam or hot water heated room. Especially adapted for houses, offices, schools and hospitals.

Specify them on your next job and save the cost of an expensive humidifying system.

Three sizes, $2.00, $1.75 and $1.00. Write for free illustrated booklet.

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San Francisco's $2,000,000 Auditorium is equipped with a

"Sirocco"
TRADE MARK.

Heating and Ventilating System—

Architects and Engineers specify "Sirocco" Systems for all kinds of buildings with an assurance that they will do their work in the most economical way possible.

San Francisco's magnificent auditorium was built to be a permanent monument to the city's progress—so heating and ventilating equipment which would give long and continued good service was selected, and that was "Sirocco."

"Sirocco" Service, a monthly publication issued by us, will be gladly sent regularly to you upon request.

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Canadian Sirocco Company, Ltd., Windsor, Ont., Manufacturers for Canada.

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

Contracts Awarded.

(Where bids for heating and ventilating equipment do not exceed $2,000, the work is usually well under way by the time the item is published in this column. Such items are only intended to give our readers a line on the activities of the trade.)

A. Calhoun & Son, Middlebury, Vt., heating Castleton Normal School, at Northfield, Vt. The contract, which is now completed, amounted to $7,000.

Blake & Williams, New York, steam heating Public School 97 at Yarmouth and Shipley Streets, Brooklyn.

W. C. Burns, Griffin, Ga., heating and ventilating two school buildings in Toccoa, Ga., for $2,792. These buildings are to be heated from one boiler, placed in the larger building. The plant, which includes 85 ft. of underground pipe and covering, a 5,100 sq. ft. cast iron boiler and 3,600 sq. ft. of radiation, was designed by F. E. Markel, of Atlanta.

Geyer & Grimes, Urbana, O., heating passenger station of the Pennsylvania Railroad at Urbana.

Northern Plumbing & Heating Co., Duluth, Minn., installing mechanical equipment for the new $70,000 parochial school under construction at Virginia, Minn. The installation will cost $15,000.

Oberlin & Reed, Wheeling, W. Va., heating new Park Theatre in Wheeling, one of the largest in the city.

Edward J. Sullivan, Kenosha, Wis., heating and plumbing new Lincoln School in Kenosha for $21,150. The bid of the Johnson Service Co. for the heat regulating system was accepted, the amount of this contract being $2,495. Mr. Sullivan, the successful bidder for the heating work, is a member of the common council and before he made his bid he was awarded the unanimous consent of the members of the council to make a contract with the city. This is provided for in the state law relating to contracts. The heating plant will be low pressure steam.

Wichita Heating & Plumbing Co., Wichita, Kan., heating and plumbing school building in Sterling, Kan., for $3,047.

Salamanca, N. Y.—Bids were received as follows for the heating and ventilating of the new West End School in Salamanca: H. B. Deitrich, Salamanca, $1,654; French & Gulick, Randolph, vapor system, $1,562; steam, with fan ventilation, $1,570; steam, $1,780; Edward T. Jones, Salamanca, hot air, $1,095; vapor, $1,275; steam, $1,455; Edward Towe, Rochester, steam, $1,483; American Warming & Ventilating Co.,

Johns-Manville Service is an evolution—the growth of half a century's endeavor to insure permanent satisfaction to users of J-M Products, of whatsoever kind. The sale of an article is not the end, it is really the beginning of J-M Responsibility.

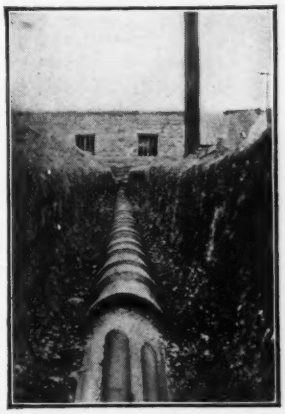
J M Sectional Conduit solves the problem of out-of-doors heat transmission

Any group of buildings may now be economically heated from a central plant. The problem of efficiently transmitting live steam, exhaust steam, hot water, etc., underground for long or short distances finds a satisfying answer in J-M Sectional Conduit.

Power in the form of live steam may now be directly transmitted.

District heating, utilizing exhaust steam, becomes more profitable.

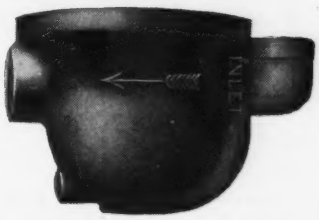
This system, which is complete in every detail except the steam pipes proper, is fully discussed in a bulletin that every architect should have on file. Nearest branch has it.



Installing J-M Sectional Conduit at State School of Mines, Rapid City, So. Dak.

A Cover, A Body, "A Ball—that's all."

The J-M
Steam Trap
Won't air bind



No steam trap can do more than the J-M Steam Trap. Many **cost** more.
J-M Steam Traps cost nothing to maintain, too. Having no trouble-making levers, diaphragms, etc., they need no repairs.
The only moving part is a seamless, non-attached rolling ball.
Water is discharged in any volume as fast as it accumulates. It will handle every service requirement perfectly. Air binding is impossible with this trap—the air is blown out with the water.
The J-M Steam Trap is as neat in appearance as it is efficient in operation. Made of the best known metal. It needs no attention but if for any reason you should desire to inspect it, the interior is at once accessible by simply removing the cover.
The J-M Steam Trap **needs no by-pass.** No steam leakage.
Write for data in new J-M Steam Trap Bulletin.

H. W. JOHNS-MANVILLE COMPANY

New York and all large cities 337-337½

steam, $1,585; Monarch Ventilating Co., steam, $2,272.

F. M. Spencer & Son, Topeka, Kan., general contract, including heating, for the new auditorium building at Ursuline Academy, in Paoli, to cost $79,000.

Neis-Freund Hardware Co., Milwaukee, Wis., heating new Holy Assumption Church, at 63d Avenue and Elm Street, West Allis.

Baker, Smith & Co., New York, heating new plant of the International Fuse & Powder Co., at Bloomfield, N. J.

Raisler Heating Co., New York, heating new store and office building at Seventh Avenue and 49th Street, for the George Backer Construction Co.

Moser & Basse, Wabasha, Minn., steam heating Farmers' and Merchants' Bank building, at that place.

Savanna Plumbing & Heating Co., Savanna, Ill., heating and plumbing Chicago Avenue School, in that city, for $8,000.

L. A. Suiter, Oskaloosa, Ia., heating and plumbing new school building in Lacey, Ia., for $3,500.

John Redmond, Muscatine, Ia., steam heating new business block in that city for $5,000.

Olympia, Wash.—Bids were submitted as follows for the installation of a heating system in the School for the Blind, to be built at Vancouver, Wash.: Beers Building Co., Portland, $2,985; Ben Olson Co., Tacoma, $3,345; West Coast Heating Co., Seattle, $3,786; Norton & Smith, Seattle, $3,923; Kendall Heating Co., Portland, $3,984; W. G. McPherson Co., Portland, $4,042; Rautman Plumbing & Heating Co., Seattle, $4,100; W. F. Bunce, Portland, $4,186; A. Gehri & Co., Tacoma, $4,180; Hugh F. Phelps, Seattle, $4,200; Appling-Griggs Co., Tacoma and Portland, $4,249; Eckart Plumbing & Heating Co., Seattle, $4,272. Bids for the plumbing work were received as follows: Fox & Co., Portland, $4,275; Beers Building Co., Portland, $4,275; Ben Olson Co., Tacoma, $4,495; A. Gehri & Co., Tacoma, $4,384. S. C. Erickson, of Tacoma, has the general contract, at his bid of $58,695.

Appling, Griggs & Co., Portland, Ore., heating and ventilating State Normal School at Monmouth, for $7,249. Other bids were: T. M. Barr, Salem, $7,718; Rushlight & Hastorf, Portland, $8,297; the McPherson Co., Portland, $8,244. Snook & Traver, Monmouth, have the general contract.

Portland, Ore.—Bids for the installation of heating and ventilating systems in the new Franklin High School in Portland have been received as follows: J. F. Shea, Portland, $22,928 (for alternate add $4,050); Appling, Griggs & Co., Portland, $22,949 (for alternate add $3,900); Alaska Plumbing Co., Portland, $23,488 (for alternate add $3,979); Rushlight & Hastorf, Portland, $23,637 (for alternate add $3,859). A previous bid by Rushlight & Hastorf, which was low when the bids were first opened, was withdrawn on the ground that an error had been made in the estimate.

A. W. Kutsche, Portland, general contract, including heating, for the construction of the Beaverton School, at Beaverton, on his bid of $18,000. The plumbing contract went to the Beaverton Plumbing Co.

Teran, Mahaney & Munro, New York, heating and ventilating new court house in White Plains, N. Y. The plumbing went to P. F. Kenny, New York.

Hutton Bros. Co., Winsted, Conn., hot water heating for Home Block, in Winsted.

Carson-Payson Co., Champaign, Ill., heating new building for the Price Estate in Champaign, for $2,116.

Daley & O'Brien, Peoria, Ill., installing heating system at the St. Charles School for Boys, at St. Charles.

E. J. Claffey Co., Chicago, Ill., heating theatre, store and apartment building, including seven stores and fifteen apartments, at Montrose Avenue and Lincoln Street, Chicago. The plumbing contract went to the Luder Plumbing Co.

National Heating & Ventilating Co., Indianapolis, Ind., was low bidder for the heating and plumbing of the new high school at Oblong, Ill. The company's bid was $11,958.

Horlock-Clow Hardware Co., Hanford, Cal., heating and ventilating Central School, for $7,480.

Robertson & Cassou, Escondido, Cal., heating and ventilating high school at that place.

Moline Heating & Construction Co., Moline, Ill., heating and ventilating East Moline High School, for $9,563. Other bids were: H. J. Schmidt, $10,789; Lockhart Plumbing Co., $10,296. The low bidder for the plumbing work was the East Moline Heating & Plumbing Co., with a bid of $2,834.

Wanted.

Position Wanted by an experienced heating and ventilating engineer who has long been engaged in the design and installation of many important steam, hot blast and hot water heating plants, including forced circulation. References. Available after November 20. Address Engineering, care of Heating and Ventilating Magazine.

(*Opportunity Talks No. 8*)

How Central Station Heat Increases the Capacity of Your Electric Plant

A steam heating service is your best means of obtaining new electrical business. Load factor is one of the most important points to be considered in an electric light and power plant, and the greater proportion of hours of operation of the equipment to the total number of hours, the greater the plant efficiency.

Underground Construction in California.

Operating an exhaust steam heating system increases the number of boiler horse-power hours, as well as the kilowatt hours, by eliminating the isolated plant, and thus tends toward the "ideal" load factor.

Our Data is at Your Disposal

covering years of experience.

Investigate the Proposition in Your Town and send for our plan. Ask for free Bulletins.

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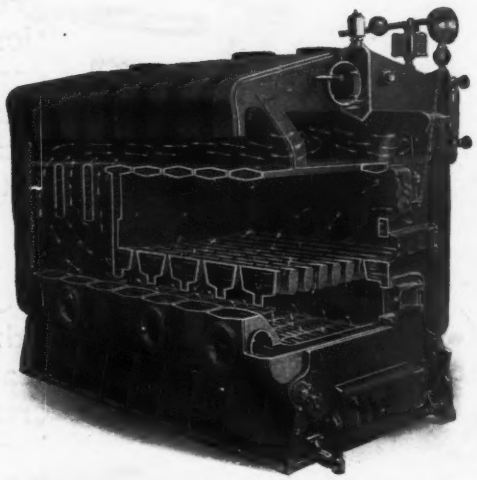
A profitable boiler

An old established principle applied in the permanent, cast iron way.

The down flow of gases from distilling soft coal to a secondary fire chamber causes complete combustion. Where there is complete combustion there is no smoke.



The IDEAL SMOKELESS Down Draft Boiler meets the most exacting requirements of any law or ordinance framed to lessen the smoke evil. No building equipped with an IDEAL SMOKELESS Down Draft Boiler has ever been censured by smoke inspectors.

The capacities of IDEAL SMOKELESS Down Draft Boilers range from 1,500 sq. ft. to 10,800 sq. ft. Steam, and 2,450 sq. ft. to 17,300 sq. ft. Water. Heating contractors all over the country are installing them in buildings of every sort.

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